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**TECHNOLOGY, BUSINESS, & POLICY IMPLICATIONS AS THE  
COMMUNICATIONS ECOSYSTEM MOVES FROM POTS TO PANS**

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I. INTRODUCTION AND EXECUTIVE SUMMARY: FROM POTS TO PANS

Telecommunications-information-entertainment (T-I-E) services are an indispensable part of our daily lives. They represent major forces in America's and the world's socio-economic, business, governmental, and cultural fabric. A major concern is that while T-I-E services are expanding rapidly and demand for them is growing, the industry is still struggling to adjust to and cope with major disruptions in technology, competition, pricing, and regulation.

Historically, telecommunications technologies, and the increasing array of services and applications based upon them, have been regulated in the public interest. These regulations mandated that all of these technologies, and services stemming from them, must be made available to Americans at all times on an equal, non-discriminatory, non-preferential basis, at affordable rates. This is why the T-I-E industry not only collaborates and co-operates; it also competes in its relentless efforts to provide an increasing array of affordable nationwide services to everyone, 24 by 7.

In the past twenty to thirty years, the industry has experienced dramatic and unprecedented technological changes. These changes have brought about profound socio-economic disruptions caused by the developing, promoting, and deploying by companies that were previously

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unheard of in the T-I-E industry (e.g. Google, Skype—which has 500 million customers worldwide; Vonage, Facebook—has recently claimed 800 million customers worldwide, My Space, Apple, Amazon, eBay, Craigslist, Match.Com, eHarmony, YouTube, and LinkedIn) that compete against, collaborate with, and depend upon existing network operators such as AT&T and Verizon, both of which operate and own nationwide wireless and fixed telephone networks, along with cable TV operators such as Comcast, Cox and Time Warner.

As a consequence of this explosion of new Internet services, applications, and providers, Internet connection time has increased from a few minutes to a few hours a day, with users demanding continuous, constant and reliable connectivity all day, every day, everywhere and year round.

Over the last several years, cellular carriers have joined the increasing array of Internet Service Providers (ISPs) by providing access to the Internet via smart phones and laptop “dongles” and wireless modems that enable Internet connectivity. The dramatic rise in wireless Internet users recently has led to efforts at cellular sector consolidation (most notably the attempted acquisition of T-Mobile by AT&T). Had this attempt at industry consolidation not been contested by the Justice Department, it would have had substantial adverse impact on competition in the T-I-E industry going forward.

It is apparent that these new technologies and an ever-growing multitude of imaginative, innovative applications are disruptive, and bestow both benefits and costs on society. This article attempts to present a review of disruptive telecommunications technologies and the disruptive services and applications developed and promoted by both new and existing companies in the T-I-E industry.

Some of the issues and questions explored and analyzed include:

- What are the major disruptive T-I-E technologies and what disruptive impacts have they had?
- What effects have these disruptions had on incumbent network operators?
- What are the impacts on regulatory frameworks in the United States, including effects on the Universal Service Fund (“USF”),

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on Inter-Carrier Compensation (“ICC”) and on network neutrality?

- Do the Voice over Internet Protocol (“VoIP”) flat rate pricing plans make business sense?
- Can VoIP operators survive on the rates offered by companies like MagicJACK, which offer services for \$19.95 a year? Can they survive in a competitive environment where the traditional telecommunications and cable TV networks, owned and operated by industry giants AT&T, Verizon, Comcast, Cox, Time Warner, et al., are responding by offering their own low flat-rate VoIP services?

This article outlines and critiques both the pricing plans of the incumbents and the business strategies of some of the challengers of the incumbent network operators. Some of the business strategies of the challengers appear to be relying on the FCC to relieve them of some of their cost burdens, e.g., the payment of access charges for the termination of their calls. The conclusion is that some of the challengers without a sustainable business plan will fail, just as many of the Competitive Local Exchange Carriers (CLECs) did either when the dot-com bubble burst at the turn of the 20<sup>th</sup> century or when the courts eviscerated the FCC’s network unbundling requirements. Others will continue to flourish and grow while expanding globally, e.g., Facebook, Skype, and Google, because of their innovative and imaginative applications.

This article also addresses consumer and collateral consequences created by the new technologies and services, outlining their pros and cons in some detail. It further details consequences of broadband deployment along with packet switching, which can carry voice, data, and video. These initiatives have impacts on the still indispensable, universal and ubiquitous Public Switched Telecommunications Network (PSTN), and the provision of Plain Old Telephone Service (POTS), since packet switched services are rapidly replacing voice-only circuit switching. This report concludes with a summary of the technology, competitive, regulatory and legislative policy issues and potential spoilers as we continue to move into the future at rapidly increasing broadband speeds.

*A. Disruptive Technologies & Disruptive Business Strategies: An Overview*

We first discuss the major difference between the Plain Old Telephone Service (POTS) and the newly emerging array of offerings by T-I-E industries. One industry expert, after reviewing the dynamic technological and business forces that the T-I-E industry is now going through, proclaimed that we are moving from POTS to PANS -- Pretty Amazing New Stuff. An illustration of the differences between POTS and PANS is shown in the chart found below:

*POTS vs. PANS: A Comparison*

<b>Plain Old Telephone Service (POTS)</b>	<b>Pretty Amazing New Stuff (PANS)</b>
Plain telephone service—voice only carried by the telephone company using copper-based facilities.	Voice carried over data networks (Voice over IP) by telephone and cable companies at low prices.
Separate networks for data services, also based on copper-based facilities.	Converged fiber-based networks that carry voice, video and data.
A future vision in the POTS era was to have ubiquitous video telephony capability that was never realized without use of the Internet.	Video telephony capability available over Internet connections, e.g., Skype, and over wireless “smart” phones as opposed to the old “dumb” analog cellular phones.
First generation cellular phones carried only voice. Subsequently, slow packet data services were available, e.g., cellular digital packet data or CDPD	A Smart Phone is a single device that combines voice services, near-broadband Internet access speeds, high quality cameras and camcorders, MP3 players and can make use of nearby WiFi networks. These devices also connect to streaming audio providers (e.g., Pandora) and streaming video services (e.g. HBO Go) on demand.
Internet access via POTS initially made use of dial-up technologies to create a modem connection. Subsequently, Internet access was enabled via an always-on broadband connection.	WiFi networks are found in many homes, businesses and public spaces to provide widely available wireless access to the Internet. Broadband penetration has rapidly increased at the dawn of the 21 <sup>st</sup> Century.
	Wireless networks have expanded to include 4G-like capabilities, e.g., WiMax, LTE, HSPA, that enable

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	high speed mobile and fixed internet access.
	Hundreds of specialized applications can be purchased for use on PCs, tablets and smart phones through online ‘app’ stores, e.g., Apple.com; Android Market.
	Specialized micro networks have been established for 1) communication between computing devices, cellular phone devices and ear pieces using Bluetooth, e.g., Personal Area Networks (PANs); and 2) communication between home appliances and electrical systems, e.g., Home Area Networks (HANs), using ZigBee technology

Source: Compiled by the authors

In his recent book, *The Master Switch: The Rise and Fall of Information Empires*, Tim Wu describes the cycle by which transformative technologies impact information-based industries<sup>1</sup> He traces the impact of several disruptive technologies of the past that have shaped and disrupted information industries, including telephony, radio broadcasting, film and television.

In the present context, we argue that T-I-E industry is now undergoing a dramatic set of changes tied to the introduction of three interrelated disruptive technologies — 1) cellular telephony; 2) the Internet and the World Wide Web; and 3) the movement of intelligence from the center of networks to the edge of networks. These disruptive technologies are having major impacts on national and global politics, social interaction and behavior, as well as industrial and business models that affect almost everything we do on a daily basis, and regulatory policy.

Extensive literature exists in economics, marketing and business, examining disruptive technologies and their impact on companies, competitive markets, and behavior. Austrian economist Joseph A. Schumpeter describes this process as one of ‘creative destruction’ in which a process of industrial mutation occurs where processes are incessantly

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<sup>1</sup> TIM WU, *THE MASTER SWITCH: THE RISE AND FALL OF INFORMATION EMPIRES* (2010).

revolutionized.<sup>2</sup> Schumpeter, who taught at Harvard until his death in 1950, was a scholar with wide interests in the social sciences and their overall effects on capitalism. Schumpeter believed that the entrepreneur is responsible for innovation, and that entrepreneurship is imitated fairly quickly, creating clusters of innovation. This economic and business trend causes an innovation boom to be inevitably followed by a bust, or depression, as markets adopt new products, new technologies, new entrants, and even new methods of business organization. A researcher of great vision, Schumpeter also forecast that the capitalist unit of production, e.g., companies and/or businesses, would become extremely large and would be run by bureaucrats. His description of the turbulence and disruptions stemming from entrepreneurship closely matches what has happened during the technological and business booms and busts of the past 30-40 years with the evolution of cable television, the Internet and World Wide Web, wireless services and applications, and deployment of broadband services.

Generally speaking, most scholarly research differentiates between disruptive innovations and disruptive business models. Schumpeter analyzed both however, and posited that they were integrally related.

#### 1. Disruptive Business-Model Innovation

Business-model innovation is represented by the creation of a fundamentally different business model and its subsequent launch into a current and existing business model. This business model could be based on either an existing or a new technology. To be called an innovation, the model must enlarge the present economic pie. Business model innovators generally do not discover new products or services. Instead, they redefine what an existing product or service is, and how the service or product is provided to the customer.<sup>3</sup>

To illustrate, Amazon began by competing with companies like Barnes & Noble in the retail book business, and did so in a fundamentally different way by focusing on a web-based shopping experience. Amazon's entry has provided consumers with a much broader array of books in the inventory, along with a more convenient way to browse and buy books. Barnes & Noble however, was a traditional "brick and mortar" bookstore.

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<sup>2</sup> JOSEPH A. SCHUMPETER, *CAPITALISM, SOCIALISM AND DEMOCRACY* (3<sup>rd</sup> ed. 1962).

<sup>3</sup> Constantinos Markides, *Disruptive Innovation: In Need of Better Theory*, 23 J. PROD. INNOV. MANAG., 19-25 (2006).

Since the early years of Amazon, Barnes & Noble has changed its model to employ both brick and mortar and web-based retailing methods and has been attempting to copy some of Amazon's innovations (such as its e-reader – the Nook, an electronic “book” similar to the Amazon Kindle). Other booksellers who have not effectively made this shift away from brick and mortar bookstores may not survive, e.g., like Borders Books which recently closed its operations.

Amazon has now embarked on another round of innovation with its November 2011 release of the Kindle Fire. This device is an advanced version of the original Kindle e-reader, now taking the form of a 7-inch tablet computer. The Kindle Fire can also surf the Web using WiFi, access email, and stream audio and video from Amazon's Internet Cloud.<sup>4</sup> The device is priced at 40% of the cost of a stripped down Apple iPad - \$199.<sup>5</sup> In effect, Amazon has managed to provide a subsidized device that its customers can use to shop at Amazon's site. The subsidy is recovered when customers actually use the device for their Amazon shopping purchases. This is a fundamental change in the computer tablet business model, and, if successful, will have implications for the sector for years to come.

In the regulated and economically critical T-I-E industry, a number of business model innovations have emerged over the past 10 to 25 years. For example, the divested Regional Bell Operating Companies (“RBOCs”), also known as incumbent local exchange carriers (“ILECs”) originally were restricted to offering only local telephone service. Subsequently, they acquired the capability to deliver long distance services, along with mobile telecommunications services. As a result, the ILECs were ‘free’ of regulatory constraints and began to offer combinations, e.g. bundles of local, long distance, and wireless telecommunications services. This enabled them to retain many customers who would have otherwise switched to competitive providers. This bundling is but one example of how telecommunications service providers and cable multiple system operators (MSOs) have changed their business models to incorporate a bundling philosophy in order to gain both competitive strength and market power by using their economies of scale.

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<sup>4</sup> See Kindle Fire Amazon Tablet (November 18, 2011), <http://www.amazon.com/Kindle-Fire-Amazon-Tablet/dp/B0051VVOB2>.

<sup>5</sup> Amazon Kindle Fire Costs \$201.70 to Manufacturer, iHS (November 18, 2011), [http://www.isuppli.com/Teardowns/News/Pages/Amazon-Kindle-Fire-Costs-\\$201-70-to-Manufacture.aspx](http://www.isuppli.com/Teardowns/News/Pages/Amazon-Kindle-Fire-Costs-$201-70-to-Manufacture.aspx).



Today, America's major telecommunications companies, (e.g., Verizon and AT&T) along with the dominant "cable TV" companies (e.g., Comcast, Time Warner, and Cox) routinely offer "triple play" (or even "quad play") bundles of services, including high-speed data, video and voice (as well as wireless which is offered in "quad plays). Moreover, cable-TV companies, which had never done so before, now offer traditional wire-line telecommunications services at prices that are, often times, less than the prices of such services when they are sold individually. Triple play is now the benchmark for consumers comparing the providers of voice, video and data services.

### B. *Disruptive Innovations*

Vijay Govindraján and Praveen Koppalle describe disruptive innovation as an innovation that "introduces a different set of features, performance, and price attributes relative to the existing product."<sup>6</sup> This is often an unattractive combination for mainstream customers at the time of product introduction because of inferior performance on the attributes these customers value and/or a high price, though different customer segments may value the new attributes." Subsequent developments over time, however, often raise the new product or service attributes to a level sufficient to satisfy mainstream customers, e.g., competitive prices, quality of produce/service, reliability, customer care and detailed billing.

According to Markides, disruptive innovations are disruptive to consumers because they introduce products and services at value propositions that disturb prevailing consumer habits and behaviors in a major way.<sup>7</sup> They are disruptive to producers and service providers because of the markets they create and because they undermine the competences and complementary assets on which existing, e.g., incumbent, competitors have built their success, market power and dominance. Disruptive innovations represent a powerful means for broadening and developing new markets and offering new innovative and imaginative functionality, which, in turn, disrupts existing market linkages.<sup>8</sup> One of the most interesting findings of Clayton M. Christensen's work is that disruptive technological innovations

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<sup>6</sup> Vijay Govindarajan & Praveen K. Koppalle, *The Usefulness of Measuring Disruptiveness of Innovations Ex Post in Making Ex Ante Predictions*, 23 J. PROD. INNOV. MANAG. 12-18 (2006).

<sup>7</sup> See Markides, *supra* note 3.

<sup>8</sup> See CLAYTON M. CHRISTENSEN THE INNOVATOR'S DILEMMA: WHEN NEW TECHNOLOGIES CAUSE GREAT FIRMS TO FAIL (1997); See CLAYTON M. CHRISTENSEN & MICHAEL E. RAYNOR, INNOVATOR'S SOLUTION (2003); Edwin Danneels, *Disruptive Technology Reconsidered: A Critique and Research Agenda*, 21 J. PROD. INNOV. MANAG. 246-258 (2004).

can and may grow to dominate and/or gain a significant and profitable share of a given market. Christensen and Raynor point out that "...disruption is a process and not an event . . . it might take decades for the forces to work their way through an industry but [they] are always at work."<sup>9</sup> Similarly, Edwin Danneels summarized the existing theory on disruptive innovation by pointing out that ". . . disruptive technologies tend to be associated with the replacement of incumbents by entrants."<sup>10</sup>

## II. DISRUPTIVE TECHNOLOGIES & BUSINESS STRATEGIES IN THE TELECOMMUNICATIONS INFORMATION-ENTERTAINMENT INDUSTRY

The breakup of AT&T, Western Electric, Bell Laboratories, and the Bell local service providers in 1984, following the launch of wireless telecommunications services in October, 1983, along with the subsequent universal and global availability of the Internet and the World Wide Web, resulted in massive and monumental changes not just in the T-I-E industry but in almost every aspect of the way we lead our daily lives. The breakup of the Bell System monopoly changed industry structure, the pricing of services and equipment, and the level of competition. The introduction of a wide array of attractive software intensive and imaginative information-entertainment services placed rapidly increasing demands on the PSTN that previously had been controlled as a near monopoly by the vertically integrated AT&T: the Bell Operating Companies, Bell Laboratories, and the wholly-owned equipment subsidiary, Western Electric. The "old" Bell System, also referred to as "Ma Bell," was "all knowing" and provided all the services and telecommunications equipment most people. The public got what the Bell System said they needed, but not necessarily what they wanted. The breakup of this centralized, closed system led to a new age, with new companies offering new technologies and a wide variety of new services based upon those technologies. The new technologies included cellular telephony, voice mail systems and packet switching, all of which we now take for granted as permanent fixtures in the T-I-E business.

The AT&T breakup has fostered a more open environment, with many companies and individuals emerging to play leading roles in the today's and tomorrow's T-I-E ecosystem.

In sum, almost everything that existed before the breakup of the Bell System has changed since January 1, 1984, including:

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<sup>9</sup> See Christensen and Raynor, *supra* note 8.

<sup>10</sup> See Danneels, *supra* note 8.

- The rise in popularity of wireless communications;
- The globalization of the Internet and the World Wide Web;
- The transformation of the cable television segment of the industry, which resulted in effective competition for the incumbent telecommunications companies for both voice and data services; (In turn, traditional telecommunications companies began competing with the cable TV companies in the delivery of video and high-speed data services.)
- The re-emergence of the satellite sector of the industry as effective competitors for video services and, to a lesser degree, for high-speed Internet services;
- Technological advances - primarily in software, wireless applications, and packet switching - that threatened the viability and capacity of circuit switched technology that constituted the original heart and soul of the PSTN.

As a result, enormous strains were placed on the PSTN. Prior to the AT&T break-up, the PSTN had existed as a single, uniform, nationwide, regulated entity offering services and technologies to all Americans on an equal, non-discriminatory and non-preferential basis to all members of the public at affordable rates, *e.g.*, prices. But something had to be done in order to respond to, and accommodate, the new services and applications being developed, offered and then ultimately demanded by populations around the world. So the U.S. Congress stepped into the fray of this potpourri of technological and business disruptive events and enacted the Telecommunications Act of 1996 (the “Act”).<sup>11</sup> The Act was designed to acknowledge the technological and business imperatives by stimulating further competition and business opportunities in every sector of the T-I-E industry. It also resulted in an increased number of mega-mergers, giving increased market power to a relatively small number of companies. These new industry giants did what the former monopoly did; they attempted to provide everything they thought customers needed by bundling, bonding, branding, and, most importantly, billing.

A number of disruptive technologies rapidly emerged in the telecommunications-information sector during the past 30 years, including

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<sup>11</sup> Telecommunications Act of 1996, as amended, 47 U.S.C. § 151-610, Pub. L. No. 104-104, 110 Stat. 56 (codified as amended in scattered sections of 47 U.S.C.).

cellular telephony and broadband technology, along with the shift of network intelligence from the traditional central office (“CO”) switch to the edge of the network. This gave more power and many more options to the end user and resulted in somewhat less control than traditionally claimed by the network operator. The telecommunications infrastructure changed because of the impact of new and disruptive technologies that have created new and unexpected demands for more services and applications from an increasingly tech-savvy public.<sup>12</sup> This, in turn, influenced the structure of the telecommunications business, the behavior of consumers and necessitated changes in the prevailing regulatory framework.

### *A. Cellular Telephony as a Disruptive Technology*

In the years immediately following the launch of wireless telecommunications services, 1983-1990, the ‘early adopters’ were corporate executives and physicians, who placed high value on the convenience, portability and immediacy of access. They also could afford the high prices charged for bulky handsets and service. When wireless services were introduced, the vast majority of subscribers remained loyal to so-called fixed line services because of their reliability, low cost, and nationwide/global coverage. Over time, further developments in cellular technology allowed service providers to offer more reliable coverage at increasingly affordable prices in order to satisfy the needs of the mass market. An examination of the shift from wireline to wireless-only households is illustrative of a trend that has emerged over the past eight years, when the percentage of wireless-only households increased from 3% to 30%.<sup>13</sup> Thus, while almost all households in 2003 indicated that they had a landline phone in the household, 30% of all households in 2010 have severed that line and rely solely on a cellular phone(s).<sup>14</sup>

There are several reasons for this shift from wireline to wireless only household status:

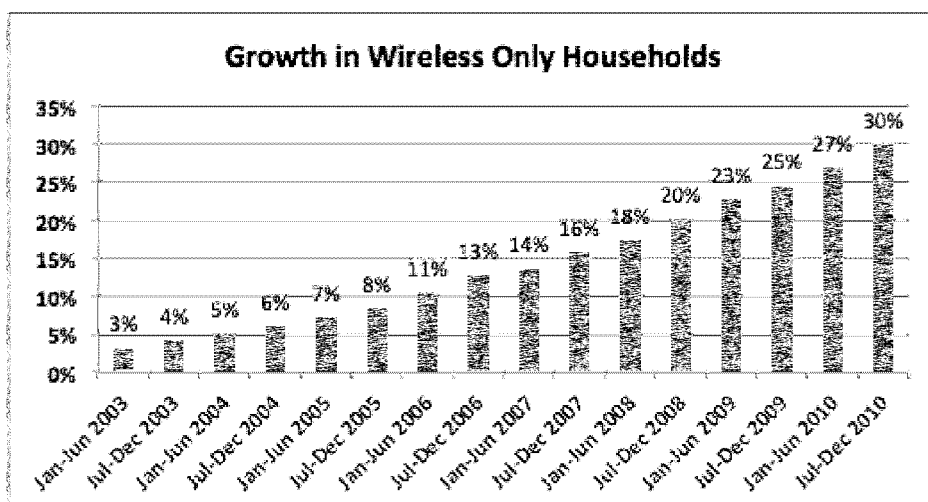
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<sup>12</sup> DALE HATFIELD, BRIDGER M. MITCHELL & PADMANABHAN SRINAGESH, EMERGING NETWORK TECHNOLOGIES, HANDBOOK OF TELECOMMUNICATIONS ECONOMICS, Vol. 2 (S. K. Majumdar, M. Cave, I. Vogelsang, eds., 2005).

<sup>13</sup> STEPHEN J. BLUMBERG & JULIAN V. LUKE, WIRELESS SUBSTITUTION: EARLY RELEASE OF ESTIMATES FROM THE NATIONAL HEALTH INTERVIEW SURVEY, JULY-DECEMBER, 2010 (2010), available at <http://www.cdc.gov/nchs/data/nhis/earlyrelease/wireless201106.pdf>.

<sup>14</sup> *Id.*

- First, the costs of voice cellular services have dramatically decreased to the point where it is now affordable for families to acquire a cellular subscription for each household member at a small incremental cost per family member.
- Second, because of this trend, callers can reach each individual directly rather than calling a household telephone number that may be answered by anyone in the household. Furthermore, because a cellular phone is personal, customized voice mail messages can be used, and the cellular phone can also send and receive text messages so that individuals can communicate through more than just voice calls.
- Third, because cellular telephones are so pervasive in our society, many have decided that there is no reason to maintain a landline telephone that is not mobile, and simply make use of a cellular telephone for their household telephone. This makes household moves easier and less expensive, since installing new telephone service is not required and household members keep their same phone numbers despite the fact that they may have changed physical addresses.
- Fourth, the use of a wireless phone in lieu of a landline phone as the primary household telephone is quite prevalent as of 2009 among adults aged 25-29 (53.5% prevalence), among younger adults aged 18-24 (45.5%), and among slightly older young adults aged 30-34 (43.8% prevalence). Since these young adults are in their prime years of new household formation, it is no surprise that the latest household trends are shifting to declining household wire-line use.



Source: CDC National Health Information Surveys released 5/14/2007 and 6/06/2011

These data indicate that incumbent wireline services are being displaced by wireless cellular firms (some of which are owned by ILEC holding companies), as suggested in the research by Danneels.<sup>15</sup>

Disruptive innovations in the telecommunications-information sector may or may not pose regulatory implications. This depends, in some measure, on their impact on the economics of telephone service in general, and their impact on existing cross-subsidization (e.g. access charges and settlements primarily in rural areas, and competitive effects on regulated services). Although there has been debate about reexamining the post-divestiture form of statutory subsidies, the fact remains that they still exist and likely will for the immediate future.

#### B. *Broadband Internet Access as a Disruptive Technology*

Broadband T-I-E services, the Internet and the World Wide Web (the “Web”), taken together, represent a disruptive technology. Furthermore, the deployment of broadband does more than simply provide access to the Internet and the Web. It makes access to the Internet a tool that has a use beyond simple web browsing and information access. The use of broadband Internet access enables an increasing array of applications including VoIP and video conferencing. VoIP to VoIP interconnection, however, is

<sup>15</sup> See Danneels, *supra* note 8.

usually made possible by utilizing the PSTN at least in part.<sup>16</sup> This has led to the development of serious competitors in the voice business, such as Vonage, Skype, along with VoIP technologies on cable networks. Some of the criteria proposed by Christensen can be used to establish whether broadband Internet access meets the test for being a disruptive technology.<sup>17</sup> Tellis succinctly summarizes the five criteria:<sup>18</sup>

- (1) A new disruptive technology initially underperforms the dominant one consistent with the historical behavior and reaction displayed by mainstream customers in major markets.
  - Broadband provides more bandwidth, but the monthly access fees are frequently quite high – at least in the initial, introductory phases of broadband deployment with relatively low speeds (e.g. DSL offered by telephone companies once offered speeds of 1.5 Mbps). Over time, transmission speeds have gone up, but prices have not increased at the same rate, creating a better value proposition for consumers. Thus, cable companies have used DOCSIS technology to deliver broadband speeds of up to 15 Mbps, while traditional telephone companies have moved away from copper-based DSL technology to employ fiber technologies (FTTH and FTTC) to reach very high rates of Internet access of 20-50 Mbps.<sup>19</sup>
- (2) Generally speaking, a disruptive technology offers features and applications that early customers value highly (because early adopters generally have high incomes). Products/services based on disruptive technologies may also be cheaper, simpler, smaller, and/or more convenient than those established by the dominant incumbent technology.

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<sup>16</sup> Mike Lahti, *Analysis of VoIP Interconnection Evolution*, <http://www.tml.tkk.fi/~anttiyj/Lahti-VoIP.pdf> (2008).

<sup>17</sup> See Christensen, *supra* note 7.

<sup>18</sup> Gerald T. Tellis, *Disruptive Technology or Visionary Leadership?*, 23 J. PROD. INNOV. MANAG., 34-38 (2006).

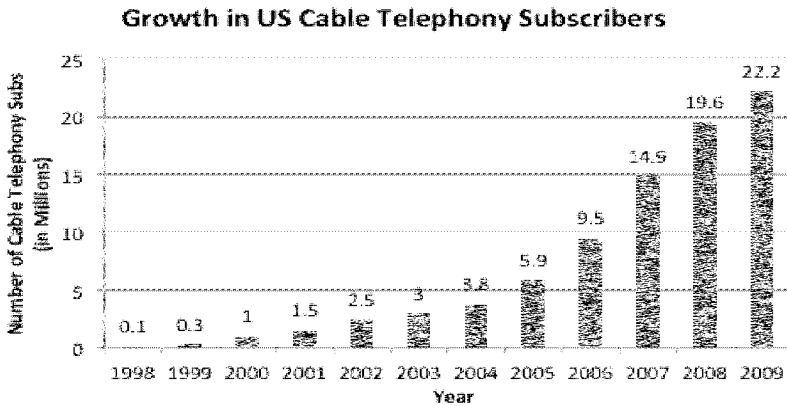
<sup>19</sup> See CORNING'S BROADBAND TECHNOLOGY OVERVIEW - WHITE PAPER: OPTICAL FIBER, (WP6321, 2005) available at <http://www.corning.com/docs/opticalfiber/wp6321.pdf>.

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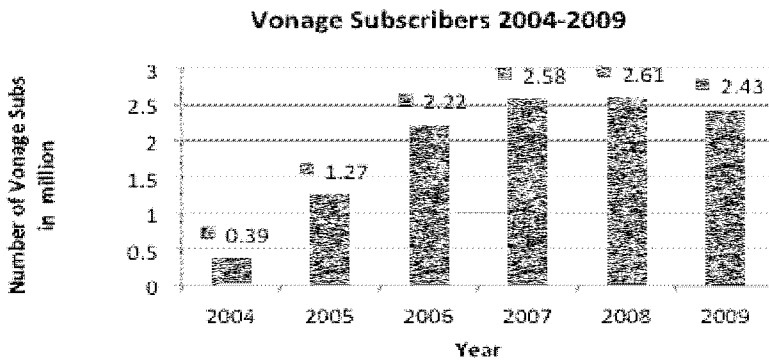
- VoIP service prices are significantly lower than those of the traditionally regulated local and long distance services offered by the incumbents, *e.g.*, AT&T and Verizon. Indeed, the monthly and even the annual rates are significantly and counter-intuitively cheaper, while also offering additional applications, which are bundled into the offering, such as caller ID, call forwarding, three way calling, call blocking and conference calling. Also, VoIP operators can add multiple lines, and voice mail can be accessed on the web. A cursory analysis of VoIP versus POTS reveals that VoIP has a distinct competitive edge, but as will be analyzed and explained in the next section, a more intensive investigation reveals inherent weaknesses in the disruptive business strategies of the VoIP companies.
- (3) The incumbent/dominant firms' current customers generally do not want products based on the disruptive technology, as they think that those products are not financially justified. Consequently these technologies are first commercialized in emerging and/or niche and possibly insignificant, markets. Incumbents may later copy the disruptive technologies with their own lower cost alternatives.
- VoIP began with completely new entrants, primarily Skype and Vonage, that offered an array of promised services at significant discounts from the prices offered by their "competitors," primarily AT&T and Verizon. Skype has become popular due to its low priced international calling plans and, of equal importance, its free global video conferencing, giving it a universal video service that none of its competitors could match. As a result, it claims to have 500 million customers globally. In addition, Skype has begun offering international telephone services, accessible via cellular and landline telephones, that provide services at lower prices than those offered by the traditional carriers themselves.
  - Vonage, on the other hand, targeted the early adopters of broadband. Since the initial introduction of VoIP, it has been copied by a plethora of start-ups that may or may not survive. More important, Vonage now is facing serious competition from cable TV companies. These companies have deployed VoIP over their own networks as a means of bringing IP based



telephony to the market. This offering also puts competitive pressures on the incumbent telephone companies. In recent years, cable telephony sales have outstripped the sales of POTS by the incumbent telecommunications service providers, AT&T and Verizon. The figures featured below give an indication of the rapid growth in cable telephony subscriptions, while subscriptions to VoIP through Vonage flattened and then have declined over the past few years. This may be due to the fact that cable TV companies bundle their cable telephony offering with broadband services in order to submit a compelling, competitively priced bundled services plan to established cable TV customers



Source: National Cable and Telecommunications Association



Source: Vonage Holdings Annual Reports

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(4) A new disruptive technology must steadily improve in performance until it meets the standards of performance demanded by the mainstream market.

- While nomadic VoIP began with a distinct disadvantage of not being compatible with existing 911 systems, this was subsequently remedied through an FCC proceeding. In 2005, the FCC issued a Report and Order ensuring that VoIP providers supply advanced 911 (E911) capabilities for their customers.<sup>20</sup> This effectively gave VoIP service comparability to POTS in terms of providing 911 services. VoIP began in the 1990s when two people using personal computers discovered that they could beat and bypass the PSTN by using a microphone and a speaker on their computers. Skype copied and improved on that business plan by incorporating the use of a camera on the computer.
- While magicJack and other non-cable VoIP providers offer all the services offered by POTS, they have some distinct flaws in their business plans. For example, magicJack provides service for about \$20 per year, plus the cost of its equipment and software. At \$20 a year, however, it is difficult to understand how magicJack can make a profit, because its overall operating expenses must exceed the \$1.67 per month that it charges each of its customers. The company, which continues to add customers because of its low prices and impressive distribution chain - through WalMart, Staples, Best Buy, Radio Shack, and others - also receives numerous customer complaints because it “blocks” calls to certain telephone numbers. In contrast, Vonage offers its services for \$9.99 per month for domestic calls - including all of the US, Canada and Puerto Rico- and \$25.99 per month for worldwide service. Despite these higher prices, Vonage has also not been profitable and had a net loss of approximately \$975 million between 2005 and 2009. Thus, the performance of VoIP services is slowly increasing to match mainstream offerings. These service offerings, however, will continue to face market difficulties as they all require users to provide their own network connectivity.

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<sup>20</sup> IN RE IP-ENABLED SERVICES E911 REQUIREMENTS FOR IP-ENABLED SERVICE PROVIDERS, FCC 05-116(June 9, 2005) *available at* <http://transition.fcc.gov/egb/voip911order.pdf>.

- (5) At some point in time the new (disruptive) technology displaces the dominant one, and the new entrant displaces and/or effectively and profitably competes with the dominant incumbent(s).
- One can see, based on our previous discussion that cellular and VoIP services are displacing POTS. Thus, broadband as well as cellular technology are, indeed, disruptive technologies. Broadband technology allows much more bandwidth than the public switched telecommunications network, allowing radical, game changing innovation, capacity and services to work off it. Broadband changing will continue to change the nature of most sectors of the economy -- in the quality and range of telecommunications services and applications, and also in numerous benefits for other socio-economic sectors including education, health care in currently un-served and under served areas, telecommuting, public safety and homeland security. Broadband allows peer-to-peer connections, giving rise to a host of new products, services and applications, including Twitter, Facebook and LinkedIn. Broadband is already introducing radical changes in a number of business and government sectors by allowing rapid digital distribution of content-rich files – TV, books, movie videos, music, and educational materials. A large number of social services, including education and health care can now be delivered via broadband facilities.
  - As a consequence of the importance to, social implications for, and potential changes to consumer lifestyles, broadband should be made available to all Americans on an equal and nondiscriminatory basis and at affordable prices. This allows broadband to fulfill its purpose by creating jobs, increasing Gross Domestic Product (GDP), and improving health care, education, and public safety among other things. Given this aim, there can be no acceptance of a so-called “digital divide” (between rural and urban areas and between the wealthy and the poorer segments of society). Thus, equal access for all Americans is the urgent current goal of the Obama Administration’s and the Federal Communications Commission’s (“FCC”) National Broadband Plan. It is the underlying reason that regulation remains necessary in order to

correct and eliminate any discriminatory and/or preferential practices in broadband availability, delivery, and pricing.<sup>21</sup>

### III. DISRUPTIVE TELECOMMUNICATIONS TECHNOLOGIES: EFFECTS ON INCUMBENTS, NEW ENTRANTS AND THE INDUSTRY

#### A. Overview

While almost all Americans are witnessing several “disruptive” impacts and effects in the T-I-E sector stemming from the early penetration of broadband technologies and services, this is merely the beginning of a broadband revolution currently in its nascent stage in the US. George Erber, in his research, speculates about the direction in which information and communication technologies will evolve as broadband penetration moves toward universal availability as new, imaginative, and innovative services become available to all Americans.<sup>22</sup> Some of Erber’s projections include:

- Switching from narrowband to broadband communication;
- Switching from wireline to wireless communication;
- Switching from centralized to decentralized control in communications technologies.<sup>23</sup>
- Switching from single computers, or local clusters, to grid or “cloud” computing.
- Switching from human control of information processes to control by autonomous artificial agents known as “infobots.”

As this happens, industry, business, educational, entertainment, information and other socio-economic structures will change. There will be

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<sup>21</sup> See ECON. & STATISTICS ADMIN. AND NAT’L TELECOMM. & INFO. ADMIN., EXPLORING THE DIGITAL NATION: HOME BROADBAND INTERNET ADOPTION IN THE UNITED STATES (2010), available at <http://esa.doc.gov/sites/default/files/reports/documents/report.pdf>.

<sup>22</sup> George Erber, *Disruptive versus Incremental Innovations in Broadband Communication: What’s Going to Happen Next?*, German Institute for Economic Research, Königin-Luise-Str. 5, D-14195 Berlin, Germany (2004).

<sup>23</sup> See Wu, *supra* note 1. As outlined above, this is how Hatfield, Mitchell and Srinagesh perceive the future where network intelligence is not centralized, as it was in the circuit switched environment controlled by dominant telecommunications companies. Instead, network intelligence would move to a packet switched software and application intensive environment controlled much more by the public, who can take care of their needs. This shift from centralized systems to decentralized systems is typical in information empire evolution as outlined by Wu.

new entrants; some incumbents will survive while others will falter. Historically, the new, energetic entrants generally have the upper hand while the “old” players will lose, unless they can remake themselves by consciously reorganizing to adapt to the new market opportunities.<sup>24</sup> Alternatively, existing well-financed market participants can gain control of the new technologies through regulatory or sheer financial pressure. Wu points out that such methods were used by Sarnoff of NBC and RCA to gain control over television technology in the late 1930s by pressing the FCC to delay the start of television service until RCA could re-engineer a more successful electronic television and deploy it in their own facilities.<sup>25</sup> This assured NBC of access to the television market as it exploded nationwide.

As broadband deploys and expands, industry structures will also change: “The wireless industry is beginning to look like the dance where you have to get a partner before the music stops...and in this case the beat of the music is being set by Apple and Google. It raises a series of questions about the new role of carriers in an Internet world dominated by the Silicon Valley giants.”<sup>26</sup>

The potential for such structural change in the industry is clearly evidenced by AT&T’s recent and failed effort to acquire T-Mobile. The proposed acquisition was reviewed and not approved by the FCC and was simultaneously the subject of an antitrust suit in the U.S. Federal District Court for the District of Columbia.<sup>27</sup> Had it been approved, this acquisition would have reduce the number of major wireless network providers from four to three, leaving only Verizon Wireless, AT&T and Sprint as nationwide operators. Furthermore, this would have given Verizon and AT&T a combined market share of over 70%, which in turn would challenge the survival of Sprint and regional network operators, *e.g.*, MetroPCS, US Cellular, Leap Wireless, and Cellular South (now known as C- Spire). The proposed AT&T/T-Mobile deal had further raised the

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<sup>24</sup> See Christensen, *supra* note 8.

<sup>25</sup> See Wu, *supra* note 1.

<sup>26</sup> Tom Wheeler, *Grab Your Partner Mobile Answers* Featured Article in INTELLIRESPONSE (June 10, 2010), <http://technews.tmcnet.com/web-self-service/topics/mobile-answers/articles/88072-grab-partner.htm>.

<sup>27</sup> United States v. AT&T Inc., No. 11-01560 (D. D.C. filed Sept. 23, 2011) (Stipulated Scheduling and Case Management Order).

distinct possibility of the return to a wireless duopoly like the one that existed in the U.S. in the 1980s and early 1990s. The proposed merger, if approved, would also have created an equipment purchasing monopoly for GSM/HSPA operations in the U.S. which would restrict GSM/HSPA equipment manufacturers to a single buyer in the U.S. – namely AT&T. Because of these and other concerns, the Department of Justice had sued AT&T to prevent the merger.<sup>28</sup> This subsequently led AT&T to withdraw its proposal and pay Deutsche Telekom a substantial break-up fee consisting of cash, spectrum and data roaming agreements.

One of the reasons for the radical change in the T-I-E business is the digitization of audio, video and other data streams, along with legislative and regulatory approvals to lift limitations on lines of business restrictions that once prevented both telephone companies and cable TV companies from getting into each other's businesses. This has allowed both the convergence and consolidation of storage, recording and transmission by a limited number of competitors rather than multiple firms specializing in their own niche markets. The rise of Apple as the largest "seller" of music (not to mention as a major supplier of cell phones) in the U.S. demonstrates how relatively new entrants from a completely different business sector can create a major, and sometimes cataclysmic disruption in a traditional sector, e.g., music recording and delivery. The meteoric rise of Netflix, which contributed to the demise of Blockbuster and Hollywood Video is yet another example where the new technology dramatically changes the dynamics and parameters of how firms compete. Digitalization of video also makes it possible to stream video over the Internet, which will allow consumers to rely on the Internet for entertainment as an alternative to using traditional cable or satellite subscription services for viewing films. For this reason Netflix is migrating its business from the mailing of DVDs to the streaming of videos over the Internet. Indeed, we see the potential for looming competition between Amazon and Netflix in the streaming video business with Amazon's introduction of the Kindle Fire.

Even newer telecommunications entrants, such as Apple and Google, however, cannot afford to procrastinate by resting on their laurels after an initial period of successes. Thus, Google has now used its Android platform to challenge Apple's position in the smartphone and PC tablet markets. In fact, during the Summer 2011, a Nielsen Report indicated that Android

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<sup>28</sup> United States v. AT&T Inc., No. 11-01560 (D. D.C. filed Aug. 31, 2011).

products iPhones by a margin of 2 to 1.<sup>29</sup> Google has enlisted the aid of several equipment manufacturers, e.g., Samsung, and HTC, to employ its Android operating system in the company's new smart-phones and tablets. More recently, Google has attempted further to "supercharge Android" by acquiring Motorola Mobility for \$12.5 billion.<sup>30</sup> This proposed deal had been under review by the U.S. Department of Justice and the European Union.

Nowhere is the need for continuous innovation more apparent than in the case of Netflix, which is currently confronting a "perfect storm" with its current business model. Several factors are now or will be contributing to strong "headwinds" at Netflix:

- Netflix's CEO, Reed Hastings, announced that Netflix would separate what had been a combined service for \$8 per month of either obtaining movies via mail or streaming video over the Internet.<sup>31</sup> These two options are now separate, so that the price for each service option is \$8 per month. This has caused considerable unhappiness in the Netflix customer base.
- The Netflix DVD mail service may soon be disrupted as the U.S. government considers whether to cut back on mail service to five days per week, while dramatically reducing both its work force and the number of Post Office facilities.<sup>32</sup>
- Wireless broadband carriers are now implementing data caps on their broadband offerings. AT&T and Verizon Wireless have capped data services under the basic service fee, while T-Mobile charges additional for data services above a 2 GB level, so that streaming of videos by 3G wireless users becomes virtually impractical, e.g., streaming of one or two videos per month on a

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<sup>29</sup> Greg Kumparak, *Android Saw Twice as Many Buyers as iPhone Over the Past 3 Months*, TECHCRUNCH (September 26, 2011), <http://techcrunch.com/2011/09/26/android-vs-iphone-sales/>.

<sup>30</sup> <http://investor.google.com/releases/2011/0815.html>

<sup>31</sup> Reed Hastings, *An Explanation and Some Reflections*, THE NETFLIX BLOG (September 18, 2011), <http://blog.netflix.com/2011/09/explanation-and-some-reflections.html>.

<sup>32</sup> See Erik Gruenwedel, *Could Possible U.S. Postal Bankruptcy Derail Netflix?*, HOME MEDIA MAGAZINE, Nov. 15, 2010, available at: <http://www.homemediamagazine.com/netflix/could-possible-us-postal-bankruptcy-derail-netflix-21154>.

wireless phone or tablet PC exceeds the cap, thereby triggering increased prices.<sup>33</sup>

- Amazon's introduction of the Kindle Fire ups the ante from Netflix' primary video streaming competitor.<sup>34</sup>

How Netflix responds to these current challenges will determine how successful the company will be in its new business model. Research demonstrates that incumbents entrenched in "old" technologies can succeed if they are also willing to adapt and creatively destroy their entrenched markets by adopting, embracing, and often blatantly copying the business plans of new competitors by using the new disruptive technologies to promote their own products and services that have the potential to attract a wide public and, importantly, profitable appeal.<sup>35</sup>

### B. *Consequences of Disruptive Technologies on POTS*

VoIP has emerged as a near-perfect substitute for POTS.

- VoIP needs to be understood as having two distinct "flavors"—what might be labeled "retail VoIP", which relies heavily upon and distributes calls directly to the PSTN, and "Peer-to Peer" VoIP (or P2P VoIP). Retail VoIP is intimately linked to the PSTN and delivers traffic over and into the public-switched network. Both Vonage and cable telephony services are intimately linked to the PSTN in this way, and have become nearly perfect substitutes for traditional PSTN voice services.
- P2P VoIP such as Skype primarily delivers calls and video directly to computers. Although for a fee, Skype users can also

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<sup>33</sup> See Stacey Higginbotham, *Carriers desperately seeking higher mobile data price*, CNN Money, November 9, 2011  
[http://money.cnn.com/news/newsfeeds/gigaom/articles/broadband\\_carriers\\_desperately\\_seeking\\_higher\\_mobile\\_data\\_prices.html](http://money.cnn.com/news/newsfeeds/gigaom/articles/broadband_carriers_desperately_seeking_higher_mobile_data_prices.html).

<sup>34</sup> See Matthew Borghese, *Amazon ups the ante by ordering more 'Kindle Fire' units*, All Headline News, November 10, 2011, available at:  
<http://www.allheadlinenews.com/articles/90064495?Amazon%20ups%20the%20ante%20by%20ordering%20more%20%27Kindle%20Fire%27%20units>.

<sup>35</sup> Stanley F. Slater and Jakki J. Mohr *Successful Development and Commercialization of Technological Innovation: Insights Based on Strategy Type*, 23 J. PROD. INNOV. MANAG., 26-33 (2006).



calls to and receive calls from PSTN numbers. As a result, P2P VoIP services such as Skype have only limited impact on the PSTN and deliver little traffic to the PSTN. In effect, Skype bypasses the PSTN and may result in decreases rather than increases in PSTN traffic, particularly on an international basis.<sup>36</sup>

VoIP has had a significant impact on the pricing of POTS, historically and reliably provided on a ubiquitous and universal basis at affordable rates by telecommunication carriers. Business plans changed immediately and dramatically now that the POTS providers also offer their own VoIP services and talk in terms of evolving from the public switched to a packet switched networks as soon as possible. In addition, the shift of many households from POTS to cellular-only service was outlined as a disruptive change in the way in which traditional network operators were compelled to change by new telecommunications technologies, new competition, and consumer trends and tastes.<sup>37</sup>

The chart below was drawn from the *FCC 2010 Telephone Trends Report* and provides an indication of the net impact of these two disruptive technologies on switched line penetration in the US—VoIP and cellular phones. It demonstrates the dramatic decline in the number of switched lines (provided by both ILECs and CLECs) over the period from 2000 through mid-year 2008. Among residential customers these lines dropped from 145 million to less than 90 million during this period. Business switched lines also decreased modestly between June 2000 and June 2004, and again between June 2005 and June 2008. It should be noted that small business were not included in earlier FCC switched line measurements, and therefore that the rate of decline due to small businesses is not fully reflected in these figures.<sup>38</sup>

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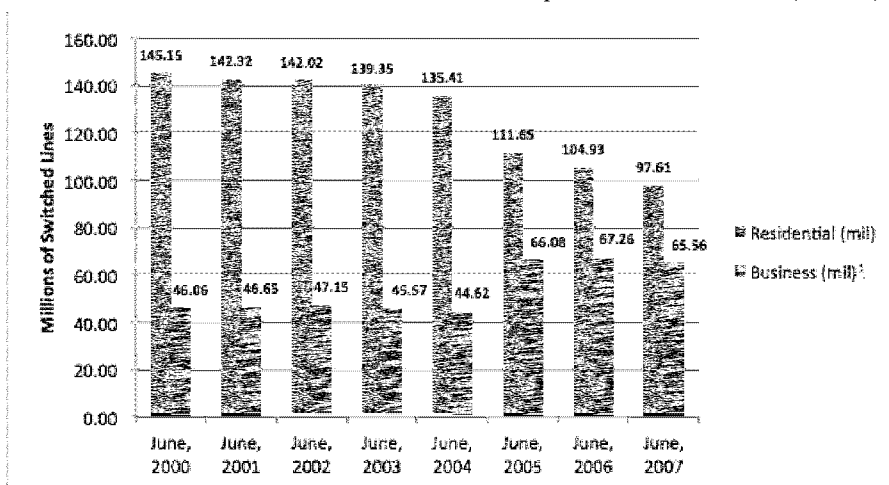
<sup>36</sup> Robert Poe, *Survey Reveals Skype's Impact on International Phone Business*, VoIP NEWS (December 18, 2007), <http://www.voip-news.com/feature/skype-international-phone-business-121807/>.

<sup>37</sup> See Blumberg and Luke, *supra* note 12.

<sup>38</sup> Federal Communications Commission, Wireline Bureau, Industry Analysis and Wireline Division, *Trends in Telephone Service* (2010) ("Telephone Trends Report"), available at [http://hraunfoss.fcc.gov/edocs\\_public/attachmatch/DOC-301823A1.pdf](http://hraunfoss.fcc.gov/edocs_public/attachmatch/DOC-301823A1.pdf).

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Residential and Business End-User Switched Telephone Lines in the US (2000-8)



Source: FCCe Report, *Trends in Telephony*, 2010.

<sup>1</sup>Small businesses were not included in measurement until June, 2005

Given that the growth of VoIP (both Retail VoIP and P2P VoIP) and wireless only households has continued to the present time, one would expect that the decline in switched telephone lines will continue for the next several years. These negative consequences (*e.g.* a digital divide, a lack of universal computer skills and literacy), along with the collateral damage to other companies or sectors, often a company expected losses in a dynamic, competitive industry. They are also trumped, it seems, by traditional US optimism for the potential of rapid socio-economic growth that new technologies bring for education, public safety, health care, telecommuting, jobs, and overall growth in GDP, etc. As long as US optimism prevails, these negative consequences will be downplayed and/or ignored. If and when they ever occur, they can then be investigated and perhaps resolved by regulatory, political, and ultimately, by marketplace forces.

### C. Pricing Strategies and the New Broadband Technologies

T-I-E services are examples of “access industries.” These are industries in which consumers have affordable and available access to the networks along with service(s), yet do not “own” the services. This access to the network service model, however, is on the verge of a potential disruptive game changer such that customers using their computers can readily and cheaply attach them to the traditional networks in order to offer their own software developed applications to other network users. Facebook,

for example, now with 800 million “customers,” including two very most popular ones President Obama and Lady Gaga—and other new, imaginative and innovative services including Skype, LinkedIn, and Match.com, all add traffic volume to the existing networks.<sup>39</sup>

This “access to a network” business model generally differs from the business model in product-based industries, in which the consumer actually buys and owns the product either immediately or over time—although product-based business models allow customers to rent or lease products, *e.g.* automobiles and TV sets or other electronic equipment.

Biggs, Phillippa, and Kelly summarize the main characteristics that differentiate broadband from previous telecommunications technologies:

- Broadband connections are typically “always on,” in the sense that is no longer necessary to dial-up first to an Internet Service Provider (ISP).
- The marginal costs to operators of greater numbers of users and capacity are close to zero (except in the case of wireless broadband, where there are capacity constraints).
- Broadband usage is mostly independent of distance-sensitive pricing, is constant within a country, and is priced irrespective of the subscriber’s location or whether the subscriber is interacting with national or international partners.<sup>40</sup>

Traditionally, telecommunications has been based on the following constructs:

- Making a call or opening an Internet session or connection;
- Pricing structures based on the time of day/week when a call/session/connection is made;
- Pricing according to the duration of a call/session/connection;
- Pricing according to the distance from the called party.

This implies that new pricing structures have been forced onto the traditional service providers and network operators by the new technologies and the new businesses. In sum, the US has gone from a situation where

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<sup>39</sup> Statistics (November 18, 2011), <https://www.facebook.com/press/info.php?statistics>.

<sup>40</sup> Phillippa Biggs & Tim Kelly, *Broadband Pricing Strategies*, INFO, Vol. 8 (6) 3-14 (1999).

networks were ‘occupied’ by customers from a few minutes to a few hours a day to the present situation in which most customer demands are constant all hours of the day and year round!

There are typically three pricing strategies that firms use in access industries: flat fee (or rate) pricing, usage sensitive pricing, and two-part tariff pricing. Flat fee pricing gives a consumer access to unlimited usage. Usage sensitive pricing is completely usage based; you pay more as you use more, with no access fee. Two-part tariff pricing includes both a monthly (or yearly) access fee, plus a usage-based fee. Current economic literature strongly advocates two-part pricing as the pricing strategy that maximizes the profit for a firm with market power. For example, Walter Oi demonstrates that two-part pricing structures allow a monopolist to set the usage price at the marginal cost and extract all or most of the consumer surplus.<sup>41</sup>

Currently, broadband capacity increases every year, as do usage and demand for those increasingly valuable and necessary services that are based on broadband availability and affordability. The question arises: what are the best pricing strategies for a firm with constrained capacity, serving customers who have different service and usage requirements, and facing competition in the market? In a recent analysis of the optimal pricing strategy, Essegaier, Gupta and Zhang model different conditions.<sup>42</sup> They demonstrate that two-part pricing is not always optimal for a firm. If there is no excess capacity, then firms can use flat rate or usage based pricing, depending on which types of customers (heavy versus light users) it is trying to attract. Their unequivocal conclusion is that flat rate pricing can ONLY be sustainable in the long run when the industry has excess capacity to cope with the increased demand that results from flat rate, ‘all you can use’ pricing. This is clearly evident among wireless carriers who are offering 3G services to their subscribers. These carriers are constrained by the spectrum available to them in different locations, and most of the carriers—with the notable exception of Sprint—have opted to either set up caps for data services where additional usage costs more, or in the case of T-Mobile, to throttle-back users’ download or upload speeds when transmissions exceed a certain level of data consumption.

These events confirm the conclusion derived from currently available research: that unlimited use flat rate pricing is sustainable when there is little

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<sup>41</sup> Walter Y. Oi, *A Disneyland dilemma: Two-part tariffs for a Mickey Mouse Monopoly*, QUARTERLY JOURNAL OF ECONOMICS, 85, (1971).

<sup>42</sup> Skander Essegaier, Sunil Gupta and Z. John Zhang, *Pricing Access Services*, MARKETING SCIENCE, Vol. 21, No. 2, 139-159 (2002).

or no excess capacity in the network, but it is sustainable where excess capacity exists. Consequently, if the existing incumbent operators are actively promoting unlimited use pricing, both on single and multi-service offerings, then their networks must have the capacity to handle today’s constant and continuous demands from an increasing number of customers seeking more services and using more applications.

IV. CONSUMER-COLLATERAL CONSEQUENCES AND REGULATORY AND/OR MARKET-BASED SOLUTIONS?

A. *Disruptions Can Both Help and Hinder Consumers*

Consumers, along with business and government, both benefit and suffer from the consequences of disruptive technologies and disruptive business models. There are also positive and negative collateral consequences. Thorny and puzzling questions confront almost everyone. Where is the T-I-E industry heading in the age of the Internet and with the rapid deployment of broadband technologies? A packet-switched, broadband era has already begun, increasing its availability across the country, and providing greater Internet access speeds and gains broader consumer acceptance. We are witnessing the beginning of an age where video, data and voice communications can be delivered simultaneously by a variety of potentially competitive networks—wire line, wireless, satellite, cable television, and even plain old broadcast TV. Broadcast television is now moving to provide mobile DTV to handheld and mobile devices.<sup>43</sup> The two tables below illustrate and summarize the positive benefits and negative consequences cellular technology and broadband Internet. It should be noted that attributes do not represent an exhaustive lists of the benefits and detriments.

**Broadband/Internet Benefits and Costs**

<b>Benefits</b>	<b>Costs</b>
Support for public safety agencies.	Cyber terrorism
Social networking (e.g. Twitter, Facebook) <sup>44</sup>	Identity theft and fraud
Medical service delivery (Firth &	Internet scams

<sup>43</sup> Open Mobile Video Coalition – About Mobile DTV – Mobile DTV 101 (November 18, 2011), <http://www.openmobilevideo.com/about-mobile-dtv/mobile-dtv-101/>.

<sup>44</sup> L. Firth and D. Mellor, *Broadband: benefits and problems*, TELECOMMUNICATIONS POLICY, Vol. 29, 223-236. (2005).

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Mellor, 2005)	
Rapid access to library information.	Spamming <sup>45</sup>
Access to information from government agencies, education, health, and business institutions <sup>46</sup>	High cost
Societal communications <sup>47</sup>	Lack of availability in remote un-served areas, plus under-served urban areas
Numerous business applications	Affordability problems
Distance learning	Quality of maintenance by providers
Telecommuting	Public becomes dependent upon Internet services and may find it difficult without internet access
Maps and navigation aids	Risk of developing/expanding a digital divide
Shopping	Internet gambling & cheating
Internet marketplace can reduce prices and consumer education	Pornography <sup>48</sup>
Provides platform for entertainment (TV viewing, movie downloads, music downloads, book downloads, Internet radio & video streaming)	Enables child predators.
Can replace teaching materials with digital content to make it more	Difficult to manage Internet exposure among children.

<sup>45</sup> “[T]he global cost of downloading advertising messages using current technology may be conservatively estimated at €10 billion – and that is just the portion of the cost borne by the web surfers themselves.” Serge Gauthronet and Etienne Drouard, European Commission, *Unsolicited Commercial Communications and Data Protection*, 67, available at [http://ec.europa.eu/justice/policies/privacy/docs/studies/spamstudy\\_en.pdf](http://ec.europa.eu/justice/policies/privacy/docs/studies/spamstudy_en.pdf) (January 2001).

<sup>46</sup> See J. Bauer, P. Gai, J. Kim, T. Muth, and S. Wildman. *Broadband: Benefits and Policy Challenges*, for Merit Network Inc, A QUELLO CENTER REPORT (2002).

<sup>47</sup> K.Reilly, *Government, ICTs and Civil Society in Central America, Working Paper No. 3, Defining e-governance and e-democracy in Central America for Action*, FUNDACION ACCESO (2002), available at <http://unpan1.un.org/intrdoc/groups/public/documents/un/unpan004391.pdf>.

<sup>48</sup> Lucy Firth & Tim Kelly, International Telecommunication Union, *The Economic and Regulatory Implications of Broadband*, ITU INITIATIVES PROGRAMME, Geneva (2001), available at <http://www.itu.int/osg/spu/ni/broadband/workshop/briefingpaperfinal.doc>.

accessible	
Able to easily and inexpensively access content worldwide	More difficult to maintain privacy.
Access to a variety of content	Potential for government control of content.
Readily available electronic newspapers, often at a reduced or no cost.	May replace newspapers & other printed matter as news-information source.
Access to more sources.	Blogs and Internet sites may not always rely upon fact-based reporting; credibility & sourcing issues.

### Cellular Benefits and Costs

<b>Benefits</b>	<b>Costs</b>
Convenience and time-saving – communications anytime, anywhere, etc	Distracted driving
Emergency use by individuals	Use can annoy others in public settings
Support for public safety agencies/law enforcement	Dropped calls
Enhances communication among household members; particularly with family plans	Early termination fees (ETFs)
Social networking, e.g., Twitter, Facebook	Poor call/voice quality
Handy still and video camera capabilities	Coverage gaps
Good for calendaring	Theft
Many mobile business applications	Use in criminal/unlawful activities, e.g., terrorism, hacking and cyber attacks, etc.
Quick text messaging	High charges for additional minutes over plan
Prices have dropped – almost universally affordable	Cyber-Text Bullying among children
No charge for long distance	Questions regarding cancer + other health risks stemming from microwave radiation
Can provide email and web access	Data pricing appears to be increasing because mobile broadband network

	capacity is currently constrained
Can provide GPS navigation.	Could serve as a distraction, endangering the life of the driver, passengers, and pedestrians
Can be used to track vehicles and people.	Jeopardizes individual's privacy interests
Can serve to validate credit card transactions.	Increased risk of identification theft
Personalized applications.	Less social interaction and community involvement
Can provide entertainment, including music and video services.	Clogging of mobile networks due to increasing bandwidth-intensive content
Attractive tool for teaching children.	Provides children with a means to access unsuitable content
Merging with VoIP to provide more inexpensive calling plans.	Could cause substantial decreases in mobile services providers' foreseen returns on network investments.
Supports e-book purchases.	May impair vision. <sup>49</sup>

Ground breaking and game changing technological and broadband service developments also create, confuse and confront consumers with major lifestyle changes. Maintaining order and socio-economic stability and growth, therefore, while avoiding the chaos threatened by cyber attacks is a question that demands the attention of all sectors of society, and not just the politicians and policymakers.<sup>50</sup>

### B. *Consumer and Collateral Consequences*

Consumer benefits of the deployments of disruptive technologies, have been widely acknowledged and referenced already in this article. The negative consequences have received little general attention until quite recently, and there is now growing attention to the negative consequences including:

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<sup>49</sup> “[T]here is a lively debate among fans of e-readers and paper books about which type of reading experience is most friendly to the eyes.” Nick Bilton, *Do E-Readers Cause Eye Strain?*, Technology, New York Times, available at <http://bits.blogs.nytimes.com/2010/02/12/do-e-readers-cause-eye-strain/> (Feb. 12, 2010).

<sup>50</sup> See Nicholas Carr, *The Shallows-What the Internet is Doing to Our Brains*, W. W. NORTON & COMPANY (2010); also see William Powers, *Hamlet's Blackberry-A Practical Philosophy for Building a Good Life in the Digital Age*, HARPER (2010).



- Cyber terror attacks on financial and government institutions that can take the form of economic warfare. There appears to be a growing fear and perhaps threat that telecommunications-information networks can both enable and disable public safety communications unless the networks are protected. This protection is often said to be unaffordable in an age of competition where the costs are passed on to:
- Identity theft privacy concerns.
- Use of cell-phones to send text messages and email and for other applications while driving or tackling other often complex and complicated daily activities.<sup>51</sup>
- Fears about the socio-economic consequences of the creation of a digital divide in the event that services are not made universally available on an affordable basis.

There are also negative collateral business consequences for certain sectors of our economy. For example:

- The newspaper and publishing sector has suffered significant business setbacks since the rise of the Internet. Some argue that there are also positives, however, that either offset and/or mitigate those setbacks.
- Radio and TV broadcasting have also felt the competitive effects of the Internet and the Web since the 1990s. The broadcasting sector, however, is fighting back with imaginative services in both radio and TV broadcast in digital technology—the latest examples being mobile DTV and 3D TV. In addition, since radio broadcasts can be accessed via the Internet, they can also be received by smart-phones, thereby opening up more opportunities to re-grow the base of listeners.

### C. *Political Consequences*

A new global communications ecosystem, enabled by the Internet through both wireless and wireline broadband, is beginning to create political consequences not seen since the political upheavals of 1848 in Europe. Street demonstrations that broke out in several cities in the Middle

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<sup>51</sup> Bob Herbert, *Tweet Less, Kiss More*, THE NEW YORK TIMES (July 17, 2010).

East, beginning in Tunisia and spreading quickly east to Egypt, in January and February 2011, quickly became known as “The Google Revolutions.”

Subsequently, these revolutionary movements, also known as “the Arab Spring,” led to the overthrow of leaders of Egypt, Tunisia and Libya. At this writing, protests continue in other nations and it remains to be seen how these situations will be resolved. These demonstrations—some called them revolutions—are not new to the T-I-E industry. In 2009, the Iranian government forcefully squelched the “Twitter Revolution.” In 2001, wireless text messages sparked demonstrations that helped bring down the government in the Philippines.

In Egypt, where President Hosni Mubarak was quickly removed from office after 30 years in power, there was an attempt on the part of the despotic Egyptian regime to shut down the Internet and wireless communications systems. This was an attempt to get the demonstrators to clear the streets and shut down their means of communication. The demonstrators, however, almost immediately thwarted the shutdown by diverting their messages to the global, public switched telecommunications network. With Google and Twitter’s cooperation, the demonstrators created multi-millions of “Speak-to-Tweet” messages that were immediately globally distributed. The goal of bringing down the Mubarak administration succeeded based, at least in part, on disruptive telecommunications technologies and services. A similar phenomenon occurred recently in Tunisia as well, quickly resulting in the leader of Tunisia leaving office.<sup>52</sup> As of this writing, other countries are also undergoing what appears to be internet-fed upheavals, including Bahrain and Yemen.

In a recent article in this journal, former FCC Chairman Reed Hundt stated that: All nations need a common medium. A common medium needs to be (1) the customary medium for the entire population; (2) very easy for people to use; (3) culturally accessible and in common language(s); (4) open to participation by everyone; (5) good for business – because economic growth should be fostered by the medium, not undercut by it; (6) providing access for the government to the people; (7) full of news; (8) sufficiently local in its manifestation for people to know what is going on around them;

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<sup>52</sup> See K. Toyama, *Twitter: It won't start a revolution, but it can feed one*, THE ATLANTIC (January 31, 2011); Thomas Wheeler, *Networks are More Powerful than Nations*, MOBILE MUSINGS (January 28, 2011) [http://www/mobilemusings.net/2011\\_01\\_01](http://www/mobilemusings.net/2011_01_01)archive.html.

(9) in a private multi-firm market; and (10) consistent with the First Amendment (one reason why it should be private).<sup>53</sup>

In spite of recent evidence regarding the effectiveness of social media in helping to drive efforts at national liberation, it is not clear how generalized this method can be. Thus, in his recent monograph, *The Net Delusion: The Dark Side of Internet Freedom*, Evgeny Morozov criticizes the “Google Doctrine, in which the enthusiastic believe in the pure liberating power of technology.”<sup>54</sup> He argues that those favoring the notion of “let them tweet and they will tweet their way to freedom” are making a naive assumption. That is, there is no reason to believe that the Internet favors the oppressed rather than the oppressor. He labels this belief as “cyber utopianism,” in which there is no recognition of the “downside.” Morozov’s experience in Belarus is instructive in this regarding. While working with a non-governmental organization (NGO) in Belarus, he discovered that when they attempted to use the Internet in order to send liberating messages, they confronted rigorous censorship. The government paid bloggers to spread government-oriented propaganda. This illustrates that the technology can be used to prop up a government as well as spread anti-government messages.

The communications ecosystem, emboldened and enabled by disruptive telecommunications technologies and services, already has become a critical component of our political, business, educational and societal fabric—not just in America but throughout the world. Much more will soon be researched and written on the global political consequences.

#### D. *Competition and Regulation*

Like it or not, government support is critical to the development of next generation disruptive technologies and services based upon those technologies. The US government had always played a pervasive, persuasive and often a positive role in the deployment of communications technologies and services, often ignored or forgotten by critics. The Communications Act of 1934 first spelled out the US’s national

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<sup>53</sup> See Reed Hundt, *The Internet as “The Common Medium,”* MED. L. & POL’Y, Vol. 19, Number II, pp. 143-148, New York Law School, 2010.

<sup>54</sup> Morozov, Evgeny, *The Net Delusion: The Dark Side of Internet Freedom*, New York: Public Affairs (2011).

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telecommunications and broadcasting policy and a plan that has enriched the country both culturally and economically.<sup>55</sup>

Highlights of the 1934 Act include:

- The FCC must encourage the larger and more effective use of radio;
- The FCC must ensure that the benefits of new inventions and developments are made available to all of the people of the US at affordable rates;
- It shall be the policy of the US to encourage the provision of new technologies and services to the public; and
- The FCC has the sole responsibility for the allocation and assignment of the spectrum upon which many of the technologies are based.

These laudable goals helped provide the nation with major business assets in broadcasting and telecommunications services that became integral parts of America's prosperous economic and business fabric to this day. The T-I-E industry today plays an indispensable role in democracy and government, in the dissemination of necessary information, entertainment and education, and in our everyday lives.

The FCC has an impressive history of using its regulatory and policymaking role to turn the United States' scarce and valuable spectrum resources into assets that have benefited the entire United States population from a public safety, national security and commercial perspective. Most of the innovations have enabled new commercial networks to launch radio and television stations, transform traditional landline telecommunications services that reliably provided dial tone into an advanced suite of network services available to individual consumers and businesses alike, and create the modern cable TV, satellite and wireless telecommunications sectors.

Now, the FCC is again at a public policy crossroad concerning the development of a policy roadmap for the broadband era. As the FCC begins this task, it is worth recalling some of the United States Government's major positive contributions that have enabled and encouraged the T-I-E to thrive and prosper.

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<sup>55</sup> Communications Act of 1934, as amended, 47 U.S.C. §§ 151-614 (2011).

The FCC's landmark policies include:

- Spectrum allocation and assignment decisions from the 1930s to date;
- Cable TV rules of the early 1970s;
- Domestic satellite decision of 1972;
- The value-added network decision of 1973 (also referred to as the packet switching decision), which resulted in an increasing array of "packet" services that became an enabler of the Internet and the Web;
- A series of the decisions in the 1970s-80s concerning the convergence of computer and communications that paved the way for Internet Service Providers (ISPs) to become interconnected with the PSTN;
- Competitive equipment decisions that paved the way for consumers to choose and pay for their own terminals, handsets, and other devices;
- The launching of a universal cellular service in October, 1983;
- The deployment of high definition digital television in 2009.<sup>56</sup>

Apart from the FCC, other parts of the federal government have made major contributions to the T-I-E industry, including the funding of the Department of Defense's ARPANET, a precursor of today's Internet. Presidents and the US Congress also supported and funded rocket and satellite technologies. President John Kennedy, for example, made a significant contribution with passage of The Communications Satellite Act of 1962 and his policy to land a man on the Moon during the 1960s.

There is, therefore, plenty of evidence to support the notion that, on the whole, United States Government policies have provided the correct technological, business, and regulatory framework for the T-I-E industry to thrive for the past 80-plus years. As pointed out by Wu, the FCC did delay the introduction of both FM radio and television services and enabled a

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<sup>56</sup> Alan Pearce, *Rebuilding the Monopoly: Will the WorldCom/Sprint merger lead to less competition and higher prices? If so, the stock market and economy will feel the pain*, TELECOM INVESTOR, (December 1, 1999); Alan Pearce *A bit of homage to the Beltway*, AMERICA'S NETWORK 90<sup>th</sup> Anniversary Issue (June 1, 1999); Alan Pearce *An Analysis of the Public Safety & homeland Security Benefits of an Interoperable Nationwide Emergency Communications Network at 700 MHz built by a Public-Private Partnership*, 16 MED. L & POL'Y 41 (2006).

small group of large broadcasters to maintain control over both radio and television broadcasting.<sup>57</sup> In spite of these few missteps and many disruptive technological, disruptive business, and regulatory decisions over the years, the industry remains strong, vibrant, competitive, and for the most part profitable. Some of the many T-I-E companies that have become well known throughout most of the world include ABC-Disney, Apple, AT&T, CBS-Viacom-Paramount, Fox, Comcast-NBC-Universal, Google and Time-Warner.

Since broadband and wireless technologies are threatening to alter the status quo, the FCC is now tackling critical policy issues—possibly aided by the US Congress and state regulators rather than leaving the issues to be fought out in the courts where costs are high (particularly for emerging competitors) and legal procrastination is rife.

In February 2011, the FCC released a *Notice of Proposed Rulemaking* (“NPRM” or “Connect America”) to reform the Universal Service Fund (“USF”) and the systems of Inter-Carrier Compensation (“ICC”).<sup>58</sup> This proceeding recognizes that the USF was originally designed to support universal communications service in costly-to-serve areas, while the ICC was designed to provide payments from long distance to local phone companies to enable service for all Americans. The NPRM acknowledges that voice services are no longer adequate to support economic development and civic life and that broadband has now become an essential component of the country’s infrastructure. As a result, the NPRM seeks to reassess the USF and ICC frameworks to make broadband available for all Americans and complete the transition from circuit-switched to IP networks.

Major policy questions generally focus on what type of broadband policy is best. This is often combined with another controversial issue: should or must the Internet be regulated? Clearly, the FCC has jurisdiction over both of these issues, though the FCC must pay attention to the Congress and to President Barack Obama. The President also has chosen the

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<sup>57</sup> See Wu, *supra* note 1.

<sup>58</sup> *Connect America Fund: A National Broadband Plan for Our Future; Establishing Just and Reasonable Rates for Local Exchange Carriers; High-Cost Universal Service Support; Developing an Unified Inter-carrier Compensation Regime; Federal-State Joint Board on Universal Service; Lifeline and Linkup*, WC Docket Nos. 10-90, 07-135, 05-337, 03-109, GN Docket No. 09-51, CC Docket Nos. 01-92, 96-45, Further Notice of Proposed Rulemaking, FCC 11-13 (adopted Feb. 8, 2011) (“USF/ICC Transformation NPRM”).

deployment of universal broadband as one of his top policy and socio-economic goals.<sup>59</sup>

Because the T-I-E industry is on the cutting edge of the nation's planned economic resurgence, the revolutionary and evolutionary pressure on the industry will produce economic, business, social and even political change.

Whatever policies emerge from the FCC and Congress, the outcome will be a pro-competition and a pro-new technology stance at the FCC and at a newly vigilant Antitrust Division at the Department of Justice—with the support of the Department of Commerce aided by its National Telecommunications and Information Administration (“NTIA”), and the Department of Agriculture.

Although the T-I-E industry is, for the most part, free of what was once a rigid regulatory and business structure, several thorny issues remain:

- What form of regulation—federal, state and local—is needed as the US moves towards an information-rich society and information-based economy?
- What kinds of high-speed, broadband infrastructures will be available, and should they be regulated?
- Should all network facilities providers be regulated identically regardless of technologies used?
- What should be the federal government's involvement in the deployment of new technologies and services based on broadband, wireless, and the Internet? This question is crucial because it has tremendous positive and/or negative implications for the evolution of services fueling the 21<sup>st</sup> century economy.
- How should regulators respond to the new types of communications-information services providers which are entering the T-I-E industry? These providers have already deployed VoIP, used the Internet and the Web for a variety of commercial services, engaged in Web broadcasting, participated in electronic commerce, and made much wider use of transaction networks.

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<sup>59</sup> See Alan Pearce & Michael S. Pagano, *Accelerated Wireless Broadband Infrastructure Deployment: The Impact On GDP And Employment*, 18 MED. L. & POL'Y 11 (2009).

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- Will the major former Bell companies, AT&T and Verizon, demand complete business flexibility over their fixed and wireless networks before they aggressively invest in, and deploy a wide array of broadband-based services, or will they reach an acceptable compromise with the FCC and others regarding the regulatory imposition of network neutrality?
- Because it is clear that future economic growth depends on the continued upgrade and expansion of the PSTN and the Internet, along with the deployment of an increasing array of broadband-based services, what, if anything, will the US government do to support the effort? For example, will more funds be appropriated beyond the American Recovery and Reinvestment Act of 2009 to spur the availability and affordability of broadband services to un-served and under-served areas of the country, or will the President's policy be opposed and/or derailed by the Republican-led House of Representatives?

Most policymakers now believe that untrammelled competition would likely damage industry and consumer wellbeing. There are at least two main reasons for this. First, major and powerful industry interests continue to pull the political, legal and policy strings to gain a business advantage over emerging competitors which need government protection in order to give them a chance to survive in competition with their powerful rivals. Second, the dominant ILECs/IXCs thus have so far been unable to persuade the FCC, the states, and Congress that real, viable competition exists at the local loop level, and their public policy arguments are weakened, not strengthened, by highlighting tiny, niche players whom they sue when they cannot get a sympathetic decision from the FCC or state regulators. In its recent ruling on network neutrality, the FCC has argued that viable competition for broadband services does not yet exist since, in most locales, there are only two significant broadband providers and in many locations there is only one.<sup>60</sup>

Meanwhile, the FCC says that it is committed to the early and speedy deployment of broadband technologies, including wireless broadband

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<sup>60</sup> *Preserving the Open Internet*, FCC, GN Docket No. 09-191, *Broadband Industry Practices*, WC Docket No. 07-52, 135, [http://hraunfoss.fcc.gov/edocs\\_public/attachmatch/FCC-10-201A1.pdf](http://hraunfoss.fcc.gov/edocs_public/attachmatch/FCC-10-201A1.pdf).



technology. The country's socio-economic growth depends in part on the FCC's tackling these critical issues over the next 12-18 months. The FCC's omnibus broadband policy initiative also includes a review and proposed expansion of the Universal Service Fund ("USF") in order to continue to support Internet access for schools, libraries and rural healthcare facilities, along with providing often needed subsidies to service providers in high-cost and mostly rural areas of the country as well as essential lifeline services for the poor.

E. *Industry Challenges in Adopting and Implementing New Disruptive Technologies*

The National Broadband Plan released by the FCC in March 2010 specified six long-term goals for broadband over the following decade.<sup>61</sup>

These goals include:

- At least 100 million U.S. homes would have affordable access to broadband with download speeds of 100 Mbps and upload speeds of 50 Mbps.
- The US should lead the world in mobile innovation with the fastest and most extensive wireless networks of any nation.
- Every American should have affordable access to robust broadband service and the means and skills to subscribe if they so choose.
- Every American community should have affordable access to at least 1 Gbps broadband service to anchor institutions such as schools, hospitals and government buildings.
- To ensure the safety of the American people, every first responder should have access to a nationwide, wireless, interoperable public safety network.
- To ensure that America leads in the clean energy economy, every American should be able to use broadband to track and manage their energy consumption in real time.<sup>62</sup>

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<sup>61</sup> *Connecting America: The National Broadband Plan*, FCC (rel. Mar. 16, 2010) ("*National Broadband Plan*" or "*NBP*"), available at <http://download.broadband.gov/plan/national-broadband-plan.pdf>.

<sup>62</sup> *Id.* at XIV.

The challenges for the T-I-E industry for addressing these goals by widely deploying broadband are numerous and include challenges from an investment and business model perspective, a geographic perspective and a technological perspective.

Investment and Business Model Challenges: From an investment perspective, it is clear that there are limits to capital availability—particularly in the recent recessionary period. For example, in its deployment of FiOS capabilities, Verizon invested some \$23 billion in capital beginning several years ago. As of March 2010, it became apparent that Verizon’s FiOS network build-out would be limited.<sup>63</sup> While the company had originally anticipated in 2004 that they would cover 75% to 80% of all its customers, it appears that they are falling shy of that original estimate. Reports suggest that the company will cut its FiOS build-out by two-thirds.<sup>64</sup>

Business models aimed at addressing broadband wireless goals are now being deployed and evaluated by companies deploying WiMAX and LTE. Clearwire has run into difficult financing challenges as it sought to broaden its financing options to continue its network build-out.<sup>65</sup> Clearwire had originally anticipated that its cable partners—Comcast and Time Warner Cable—would provide a substantial boost in the marketplace. Now, it appears that wireless offerings are not yet a robust part of the cable companies’ offerings. Indeed, Time Warner Cable reported that their mobile WiMAX service marketing results were “not very impressive and pretty inconclusive.”<sup>66</sup> Furthermore, Cox announced in November 2011 that it will discontinue its wireless service.<sup>67</sup>

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<sup>63</sup> K. Bode, *Baltimore Wants to Know Why They Aren’t Worthy of FiOS*, DSLREPORTS.COM, February 24, 2010, <http://www.dslreports.com/shownews/Baltimore-Wants-To-Know-Why-They-Arent-Worthy-Of-FiOS-107050>.

<sup>64</sup> K. Bode, *So, Is This Where Verizon’s FiOS Deployment Ends?*, DSLREPORTS.COM, March 12, 2010, <http://www.dslreports.com/shownews/So-Is-This-Where-Verizons-FiOS-Deployment-Ends-107342>.

<sup>65</sup> L. Luna, *Sprint: We face problems if Clearwire defaults on loans*. FIERCE BROADBAND WIRELESS, November 6, 2010, <http://www.fiercebroadbandwireless.com/story/sprint-we-face-problems-if-clearwire-defaults-loans/2010-11-08>.

<sup>66</sup> *Id.*

<sup>67</sup> Cox Communications Press Release, November 15, 2011. Cox Communications to discontinue Cox Wireless Service, Effective March 30, 2012.

Geographic Challenges: Implicit in the National Broadband Plan is an effort to ensure that a digital divide does not emerge such that rural areas are left out of high speed broadband access deployments. The underlying cause of such problems is due to the fact that areas with low population densities are very costly to serve on a household-by-household basis. As a result, such areas are less likely to be targeted for deployments by Internet service providers. In light of such concerns, the National Telecommunications and Information Administration's Broadband Technology Opportunity Program (BTOP) and the Rural Utilities Service's Broadband Implementation Program (BIP) focused their funding on areas that were un-served or underserved (most such areas are the less densely populated parts of the country). While deployments undertaken by the broadband stimulus programs run by NTIA and RUS are still under way, the FCC reported in July 2010 that between 14 and 24 million Americans lack access to broadband and that "the immediate prospects for deployment to them are bleak."<sup>68</sup> This suggests that the BTOP and the BIP investments will not soon address all of the broadband needs in rural areas.

Technological Challenges: The typical solution for providing broadband in rural areas involves the use of wireless broadband such as WiMAX and LTE. As noted above, however, Clearwire, one of the major WiMAX providers, is facing financial difficulties and does not appear to possess the ability to build an effective business model.

From a technological perspective, wireless broadband is not a perfect substitute for wired broadband. That is, wireless is not yet as fast as wired broadband and, in any finite location, cannot support as many users. In addition, spectrum assets to support wireless broadband are not readily available in all locations. For this reason, the FCC has opened a docket to provide for the repurposing of broadcast spectrum so that it might be used to address wireless broadband needs as outlined in the National Broadband Plan.<sup>69</sup> This proceeding may allow new allocations for fixed and mobile

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<sup>68</sup> *Sixth Broadband Deployment Report*, FCC, GN Docket No. 09-137, *Inquiry Concerning the Deployment of Advanced Telecommunications Capability to All Americans in a Reasonable and Timely Fashion, and Possible Steps to Accelerate Such Deployment Pursuant to Section 706 of the Telecommunications Act of 1996, as Amended by the Broadband Data Improvement Act* (July 20, 2010), available at [http://transition.fcc.gov/Daily\\_Releases/Daily\\_Business/2010/db0720/FCC-10-129A1.pdf](http://transition.fcc.gov/Daily_Releases/Daily_Business/2010/db0720/FCC-10-129A1.pdf).

<sup>69</sup> *In the Matter of Innovation in the Broadcast Television Bands: Allocations, Channel Sharing and Improvements to VHF*, FCC Notice of Proposed Rulemaking, ET-Docket No. 10-235 (November 30, 2010).

services in the UHF and VHF bands. This is part of a larger initiative undertaken by the FCC to acquire as much 500 MHz for wireless broadband purposes including:

- Building wiring in the US is a hodge-podge of vintages, gauges, wiring plans and connectors. Because of their low frequency, analog nature, voice signals can be transmitted and received relatively unscathed over this diversity of wiring. What will be the effect on high-speed digital signals, and who will take responsibility for ensuring performance?
- The 150 million copper loops that connect residential and most small offices consist of inexpensive, unshielded twisted pair (UTP) cable. For UTP to carry both low-speed analog and high-speed digital signals, a different approach to network maintenance and testing is needed for ingress and egress interference. This places a major financial burden on local telecommunications companies, and it must be administered and paid for. How will this be handled in a new business (and regulatory?) model?
- The addition of tens of millions of lines of high-speed data to the existing voice network will cause an increase in background noise. This may necessitate changing the performance of already deployed equipment, perhaps especially in rural, high-cost areas. How will the service providers cope?
- An increasing number of consumers have a choice of receiving their telephone and TV signals over two different wired networks. These networks are also delivering data signals containing text and graphics, etc., to PCs and TV sets. Existing optical and electrical technologies can combine and consolidate the two networks. Should the barriers that stand in the way of doing so be eliminated?

### F. *Potential Technical and Regulatory Issues*

Some technological and policy—even possibly legislative and/or legal—issues are particularly difficult to resolve because they may not even surface until mass deployment of high-speed services are made available on a universal, non-discriminatory, non-preferential basis at affordable rates. If the T-I-E industry is to smoothly migrate from today's circuit-switched

networks to a broadband network based on fast packet protocols, all groups must join to identify and solve problems before they arise. The most important technological and capital investment in infrastructure issues confronting the policy makers and the T-I-E industry are:

- How can technology be best applied to create a high-speed network with the least amount of disruption to the existing infrastructure(s)?
- Wireless spectrum is now widely available, especially with the emergence of 4G and the availability of 700 MHz. Both narrowband and broadband services can be delivered over the airways by all types of companies, e.g., Google-Verizon, Apple-AT&T, etc. Since wireless is at once an array of services—some more essential than others — where does a network, and also a disruptive technology fit into the T-I-E industry? Should it be regulated when used for POTS, quasi-regulated when it provides data, and unregulated when used for video and entertainment?
- How will the growth in wireless and VoIP technologies impact the investments to be made maintaining the PSTN network, on which most of America depends?
- Are there new dangers of bypassing the PSTN via Skype-to-Skype, peer-to-peer, and other connections that may cause significant revenue losses or degradation of service on the PSTN?
- Are cable TV operators really offering VoIP services or a hybrid service with a strong reliance on the PSTN? There is significant regulatory confusion with cable telephony that runs on the private network of the cable operators and eventually interconnects with the PSTN.
- What should be the regulatory treatment—federal, state or local—of Verizon’s FiOS and AT&T’s U-verse’s video, entertainment, information and other broadband services offerings in a single bundled package? Are these a continuation of the investment in the PSTN or are they completely separate? If these services are relying in part on the PSTN, how is that accounted for so that regulators can determine whether costs are appropriately accounted for? If these services are defined as separate in a

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bundled environment, how do the regulators determine whether the prices charged are just and reasonable?

- How will all of these dramatic changes in services and applications affect long-term consumer behavior? For example, for those who have already cut and/or plan to cut their landline connections, will they also move from over-the-air TV and cable TV to TV on the laptop or smart phone devices, using the plethora of applications developed and offered via broadband and 3G/4G wireless networks, etc?
- The plight of disabled and disadvantaged users must be resolved by applying state-of-the-art broadband technological solutions to specific problems and needs. Support for technologies that enable people to communicate by means other than sight, sound, hearing or keyboard strokes, and which make access to communications easier for disadvantaged users, must be a policymaking priority. Accompanying this must be a renewed effort to create more effective and secure communications for the law enforcement and public safety so that they can more quickly and effectively respond to disasters and catastrophes as they attempt to protect lives and property.

### V. SUMMARY AND CONCLUSIONS

The T-I-E industry has increased economic activity, job creation, and wealth throughout the world. It will continue to do so if appropriate policies are put into place to continue and encourage existing and new services, along with the deployment of new technologies, on a ubiquitous, universal basis, free from discrimination and preference, at affordable rates. Neither the United States nor the rest of the world can afford to accept, allow or acknowledge a global communications system that fails to be inclusionary.

In an all-inclusive, completely interconnected system, there is an opportunity for everyone to gain from the increasing array of services and applications that enable the provision of educational and job related skills, provide better health care, improve law enforcement and public safety systems, provide high-speed information and data to improve business and government responses and efficiency, while also allowing people to telecommute and engage actively in social and political networking.

Because T-I-E services are indispensable, there is an important imperative, namely the role of governments and regulatory bodies. The T-I-

E industry is of such significance that it demands regulatory and legislative oversight on a continuing basis, not just to protect and promote the public interest, but to develop and oversee rules protecting “infant” competitors and emerging competitors from unfair competition by vested incumbents that may have significant market power that can be used to impede or eliminate competition. Competition itself is not an adequate regulator, as some believe and advocate by pressing for deregulation. The market, like all things, is not and will never be perfect.

Previous historical analysis documenting the emergence of previous disruptive technologies in the information sector revealed that following the introduction of new, successful innovation (including the telegraph, the telephone, film-making, commercial radio and commercial television), and attempts by entities with market power to monopolize and centralize control over such innovations.<sup>70</sup> Thus, what had originated as an open environment quickly became dominated by a small number of market participants and was closed to new entrants and innovation by others. Such a result is clearly counter to the goal of broadening the reach of such innovations and has had a stifling effect on markets. This historical record underscores how important judicious regulation is to fostering the development and growth of new, disruptive technologies. In the absence of effective regulation, wealthy and powerful market participants can attempt to claim innovations for themselves and paradoxically close off potential future innovation.

Regulators also must insist, and public policies should reflect, that networks be available to everyone at all times and that originated calls are neither improperly terminated nor blocked. The business basis of network operators, from the beginnings of the FCC to date, have been to guarantee and encourage complete open access, and not to allow network operators to impede or deny it. As has been demonstrated above, the research on T-I-E service pricing is clear and unequivocal: flat rate pricing for unlimited network use can only be sustained when there is excess network capacity, regardless of which network is being used, be it wired, wireless, or satellite. Regulators must hold network operators accountable for their promises to customers, and insist that network operators that promote unlimited services for a flat monthly rate should be made to live up to that commitment by proving that there is, in fact, excess capacity available for all customers. If network operators fail to fulfill the promises implied and implicit in flat rates, then regulators should enforce penalties on those operators who do not

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<sup>70</sup> See Wu, *supra* note 1.

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meet the requirements, as opposed to leaving customers to suffer the consequences.

Network operators have often posed the question: if we build it, will customers come? This report demonstrates that the demand for network capacity appears to be increasing geometrically and possibly exponentially, so public policy must allow customers to assert control over their access to, and use of, the network as it evolves. Regulators must encourage and induce network operators to live up to their marketing promises by increasing capacity and focusing anew on customer care.



