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IDEAS

The Crucial Role of Local Number Portability in Today's Telecommunications Industry

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Thanks to the groundbreaking discovery of the telegraph by Samuel Morse in 1837 and the telephone by Alexander Graham Bell in 1876, today we have access to telecommunication services and devices of all types. From innovations as unique as wireless Internet access on cellular telephones to the standard plain old telephone in our homes, living without telecommunications is unimaginable. People often look back in wonder at the development of major historical technological inventions; the telephone is no exception. The story of how Alexander Graham Bell invented the telephone has been immortalized through several movie and theatre productions, television documentaries, and historical writings. These historical accounts often favor the drama of the invention and discovery process, but often reveal little about the events which surrounded its societal implementation. Analysis of early telephone technology deployment reveals important lessons about competitive market forces and regulatory issues that can be applied to two important emerging issues: local telephone number portability and depletion of telephone numbers. Local number portability is the ability of customers to retain their telephone num-

ber when they change telephone service providers.

Regulations heavily influence the success, failure, and creation of any new technologies in telecommunications.

Historical analysis of competition in the telecommunications industry, since the invention of the telephone, provides insight into three main issues. First, history will prove anti-competitive regulatory control is detrimental to technological innovation in the telecommunications industry. Second, local number portability could save the telephone numbering system from eventual depletion. Third, and most important, why local number portability is essential to competition for local telephone service. A review of how local number portability is envisioned will demonstrate how this new concept will bring numerous benefits to the consumer in the new competitive telecommunications industry.

Historical Viewpoint: Competition in Telecommunications

According to Rowe (1999), patents issued to Alexander Graham Bell for the invention of the telephone in 1876 expired in the early 1890s, allowing several independent telephone companies to

begin competition with the quickly growing Bell Telephone Company. Within six years of the expiration of Bell's patents, over 6,000 independent telephone companies competed with one another (Todd, 1999). Consequently, many telephone companies operated in the same city. However, problems arose for the fledgling telephone industry as competing companies refused to interconnect their systems. Without interconnection, individuals served by different telephone companies could not call one another. By not connecting competing systems, some companies were able to hold advantage over others and attract more customers. Once the competition could no longer survive, they were bought out, typically by the Bell Telephone Company. This business strategy created an obvious flaw in the deployment of telephone technology, the inability of the customer to have ubiquitous telephone service.

Absence of regulatory oversight allowed the Bell Telephone Company to rapidly expand as a result of buying other smaller telephone companies. Shaw (1998) observed that rapid growth and assertive posturing of Bell's company served as a motivator for the federal government to establish

regulatory control over the telecommunications industry. In 1913, the competitive tactics of Bell Telephone, renamed AT&T on December 31, 1899 (Todd, 1999), caused the U.S. Justice Department to invoke the Sherman Antitrust Act. According to Lynch (1996), the 1913 Kingsbury Commitment was an agreement between AT&T and the Justice Department that temporarily slowed AT&T's acquisitions of independent telephone companies. More important, Rowe (1999) indicated that the agreement recognized the importance of a common telecommunications infrastructure by requiring interconnection between AT&T and the telephone companies that had not yet been purchased by AT&T, thus providing universal nationwide telephone service.

With such a large number of people being added to the telephone network, automatic switching mechanisms eventually had to be developed to make the connections from one party to another. Telecommunications technology rapidly advanced. Long distance services were deployed and tremendous improvements were made to deliver local telephone services. However, competition soon ended.

Competition Ends and Monopolies Begin

Cole (2000) reported that regulatory action by the federal government in 1921 formally recognized legitimate monopolies of telecommunication carriers by exempting them from the Sherman Antitrust Act. This regulatory action effectively ended competition in the telephone

industry for several decades. The concept of the telecommunications common carrier was firmly established. Common carriers are heavily regulated industries that by law are allowed exclusive rights to be the sole provider of services in a given geographic region. In return, companies are guaranteed a specific monetary return based on their infrastructure investment and cost of operation. Government agencies determine the rate of return for these monopolies to protect consumers.

With regulatory oversight, the technology of the telephone network continued to develop across the nation. However, two problems emerged: lack of competition and vertical integration of the industry. First, AT&T operated with a guaranteed rate-of-return and no competition, the motivation for AT&T to develop new technologies for the consumer did not exist. Early technological developments that could have benefited consumers were discouraged by AT&T and the Federal Communication Commission (FCC). The FCC was created in 1934 to regulate the fledgling telecommunications industry. According to Knauer, Tollin, Zachem, and Pastor (1998) in 1954, AT&T convinced the FCC to deny an early version of the answering machine. The FCC also denied a small plastic cup called the Hush-A-Phone that attached to the telephone mouthpiece to allow for more privacy during conversations. The concern at the time was that devices developed by companies other than AT&T could be harmful to the telephone network. This theory served as a barrier to the development of new

services for customers for several years.

Although competition kept technological development for the end-user from advancing, "switching technology"-defined here continued to evolve because of the vast numbers of customers being added to the telephone network. According to Lynch (1996), several new network-enhancing technologies were developed during the monopoly of AT&T. Bell Laboratories, the research and development division of AT&T, was busy inventing the coaxial cable, microwave radio transmission, laser technologies, and the transistor which led to electronic switching and tone dialing.

The motivation for improving technology of the network (rather than the technology and services for the consumer) was profit based. With better switching and more capacity for additional telephone calls, telephone companies could make more money. Wenders (1987) believes the rapid technological change, which has permeated the telecommunications industry, has focused primarily upon economies of scale for telephone companies. Little change has occurred in the actual delivery of services to the customer.

A second problem emerged as AT&T found a way to inflate their rate of return beyond what the government allowed. AT&T owned Western Electric, the company that produced the infrastructure for telephone systems. The price of the equipment was purposely overly inflated, and therefore the rate-of-return determined by the government was also inflated (Peck, 1988). This meant higher prices for the

consumer. Thus began the decades-long process of de-regulating the telecommunications industry.

The Era of De-Regulation

Although the telephone network was heavily mired in regulation, preventing competition for several decades, other subindustries within telecommunications were allowed to develop in a competitive environment or were de-regulated through court action. Knauer et al. (1998) revealed that MCI had to sue to gain entry into the long distance market once monopolized by AT&T. MCI's successful legal efforts and the famous breakup of AT&T's Bell Telephone system in 1983 created the competitive industry of long distance. AT&T, in an agreement with federal regulators, was required to divest their local telephone companies, known as Bell Operating Companies. This resulted in AT&T becoming a competitive player in the long distance market (Cole, 2000). For several years after 1983, long distance services continued to be dominated by AT&T with little competition. Accessing long distance lines for AT&T was accomplished by dialing the digit one. Until switching equipment could be changed so that dialing one provided access to the long distance company of choice, AT&T held competitive advantage. Bell Operating Companies, divested from AT&T, were limited by regulation to provide only local telephone service. They were not allowed into the lucrative long distance market. The long distance market has become increasingly competitive ever since 1983, and

consumers are now provided a choice of companies, choice of long distance packages, and increased savings on long distance charges.

Kuruppillai, Dontamsetti, and Cosentino (1997) indicated that the FCC chose to favor a competitive approach in the awarding of the first cellular licenses. Licenses for frequency spectrum were granted in a duopoly format to create competition between two cellular carriers in each market. The resulting competition, and reduction in regulatory oversight, has been the rapid technological development of cellular telephones with more features to serve an increasingly mobile community. An example of new technologies in wireless is the personal communications system (PCS). PCS is a new technology that is similar to the cellular telephone in concept but operates in digital rather than analog format. PCS telephones are cheaper, more efficient, and safer to operate than analog cellular. Paging is another competitive industry with new features developing rapidly. Most recently we have seen the deployment of worldwide satellite telephones in competition with cellular telephones. Wireless services experience a high level of competition with rapidly advancing technology and increased services for the consumer. Individuals can now surf the Internet, obtain stock quotes, and receive faxes over their cellular telephones. All this would have been impossible without competition.

The most personally important element of de-regulation is that consumers now own their

own telecommunications devices; this is referred to as "customer premise equipment." According to Newton (1998), customer premise equipment is any telecommunications device owned by the consumer that is attached to the telephone network, including items such as telephones, modems, fax machines, and answering machines. Historically, telephone companies justified the renting of the telephone instrument, by saying that the telephone network might suffer harm from any equipment that did not meet its specifications. As a result, everyone had the same standard rotary dial telephone for years. Customer premise equipment was fully de-regulated in 1983 as a part of the breakup of AT&T. As the production and sale of these consumer devices emerged into a competitive market, many technological innovations began to occur. An entire industry sprang up overnight competing to develop answering machines, telephones, modems, and fax machines. The de-regulation of customer premise equipment is probably the most significant catalyst for the emergence of telecommunications as a competitive industry.

In its infancy, the telecommunications industry was highly competitive. At first, competitive pressure by AT&T created a monopoly that was later affirmed by Congress. Once society realized the benefits of a competitive telecommunications system, it was approximately 50 years before the final segments of the telecommunications industry was de-regulated. Long distance, cellular telephony, and customer

premise equipment are all examples of competitive components of the telecommunications industry. They have become competitive through court action or regulatory decisions by the FCC. These competitive segments of the telecommunications industry have brought reduced costs and increased diversity in services to the consumer. However, new concerns have emerged.

Competition Brings Problems

Unfortunately, the technologies and services that developed in a competitive market are beginning to have a negative impact upon the telephone network. The implementation of pagers, fax machines, cellular telephones, personal communication systems, and computer modems, are placing tremendous pressure upon the North American telephone numbering system. Each individual communication device requires a unique identification number (i.e., a telephone number) to be recognizable on a telephone network. As a result, telephone numbers are being consumed at an alarming rate. In response to the problem, the FCC has opened an inquiry to determine how telecommunications companies can more effectively utilize telephone numbers. The FCC Common Carrier Bureau (1999) indicated there are 215 area codes today as opposed to only 119 in 1991. Of the 215 area codes, 70 are soon to have all their telephone numbers exhausted. Once the available combinations of telephone numbers in an area code are exhausted, a new area code has to

be created. This creates undue hardship on the individuals and businesses in the affected area. The bureau further estimated that all area codes will be consumed in 10 to 15 years if nothing is done to alleviate the impending number plan failure. One potential answer to saving the numbering system is to add an 11th digit to the current 10-digit telephone number. This move would cost telephone companies, and ultimately their customers, more than 150 billion dollars and take at least 10 years to complete. Adding an 11th digit to the telephone number would require additional regulatory oversight. Implementation of local number portability may provide a better solution through competition.

Local Number Portability

On February 8, 1996, President Clinton signed the Telecommunications Act of 1996 into law. The act is based upon the concept that all sectors of the telecommunications industry should be open to competition. This act removes all the regulatory barriers that once existed. One of the most important sections of the act, according to Gable (1999), was the creation of competition in the heavily regulated local telephone sector. The act mandates the implementation of local number portability to facilitate competition in the local sector.

The Telecommunications Act of 1996 defined number portability as "the ability of users of telecommunications services to retain, at the same location, existing telecommunications numbers without impairment of quality, reliability, or convenience when

switching from one telecommunications carrier to another" (FCC, 1996, paragraph 7). According to the Midwest Region Local Number Portability Administration Center (n.d.), there are three different types of number portability. (1) Service provider portability allows consumers to retain their telephone number while changing to a different service provider. This could include changing from a wireline to a wireless service provider. (2) Location or geographic portability lets consumers change from one geographic area to another and retain their telephone number. (3) Service portability enables people to change from Integrated Services Digital Network (ISDN) to Asymmetrical Digital Subscriber Line (ADSL) or basic telephone service and still retain their telephone number. ISDN and ADSL are types of services requiring specialized communications equipment, which dramatically speed up Internet connections to the home or business. Currently, the only form of local number portability required of telecommunications service providers is service provider portability (FCC, Common Carrier Bureau, Competitive Pricing Division, 1999). At this time, wireless service providers are excluded from service provider portability, but eventually the local number portability regulatory mandates will extend to the wireless industry.

To create competition among once monopolistic local telephone companies and enhance competition in other telecommunication markets, consumers need to be able to retain their telephone number as they change service

providers. As reported by the FCC, studies conducted by several telephone companies reveal that consumers have little interest in changing their service providers if they have to change telephone numbers. “Based on a nationwide Gallup survey, 83 percent of business customers and 80 percent of residential customers would be unlikely to change local service providers if they had to change their telephone numbers” (FCC, 1996, paragraph 29). Gable (1999) indicated that the “principle road-block” to competition among local telephone service providers is the issue of “the ability of a customer to retain his telephone number after changing local service providers” (p. 15). The primary issue is cost and identity. Individuals who have had the same telephone number for years lose a certain identity when they are required to change their number. For businesses, can be staggering. Imagine changing a number in every location where a business’s number appears; the costs can be quite high. Advertising on billboards, signs on vehicles, yellow page advertisements, newspaper ads, and new business stationery all add up to major costs and headaches.

The Technology of Local Number Portability

To make local number portability functional, restructuring the way calls are routed must take place. Prior to local number portability, telephone calls were transmitted across the network on the basis of a 10-digit telephone number. Telephone numbers

contain an addressing scheme with a defined format. The first three sets of digits contain the area code, a broad geographic area sometimes encompassing several local telephone companies. The next three digits contain the exchange code, which is the number that uniquely identifies a specific central office of a telephone company. A telephone company may own several central offices that each serve a specific geographic area. The remaining four digits is the subscriber code, which identifies the specific customer served by a local telephone company. If a person dials long distance an 11th digit is added to the beginning of the sequence. Dialing the number ‘1’ in the United States indicates a long distance call, but the number ‘1’ is actually a country access code identifying the call as a U.S. call. The access code also indicates that a long distance carrier of the customer’s choice will be used to complete the call. When local telephone companies convert to local number portability the 10-digit telephone number will no longer be feasible to route telephone calls across the telephone network. For example, if customers decide to change from their current local telephone company to a competitor and retain their telephone number, a different call routing scheme must be utilized. The new routing scheme uses a location routing number. However, before a routing number can be assigned, the customers must change service providers; this process is called “porting.”

Porting is a complex process with a series of checks and balances built in to protect the customer.

Perhaps you may recall the concept of long distance slamming? When a long distance company changes a person’s long distance carrier without that person’s permission, they have been slammed. In order to prevent local number portability slamming between competing telephone companies, seven Number Portability Administration Centers (NPACs) have been established in specific regions of the country. Their role is to maintain databases of all ported telephone numbers, and they are required to administer the transfer of customers from one telephone company to another. This process ensures a neutral third party is completing the transfer, guarding against fraudulent activity. The following describes the process of porting (Refer to Figure 1). First, the new competing local telephone company manages to win the business of a customer currently served by the telephone company that has been in the area for several decades referred to as the incumbent. In the parlance of telecommunications, the competitor is called the Competitive Local Exchange Carrier (CLEC) and the incumbent is called the Incumbent Local Exchange Carrier (ILEC). The CLEC forwards a porting request to the NPAC. Since the customer cannot be without telephone service even for a few minutes, the NPAC must also be made aware of the exact date and time to process the transfer. Next, the NPAC alerts the ILEC of the porting request. In some cases, the ILEC then contacts the customer to validate the request. The ILEC must then acknowledge the porting request to the NPAC and confirm date and time of the

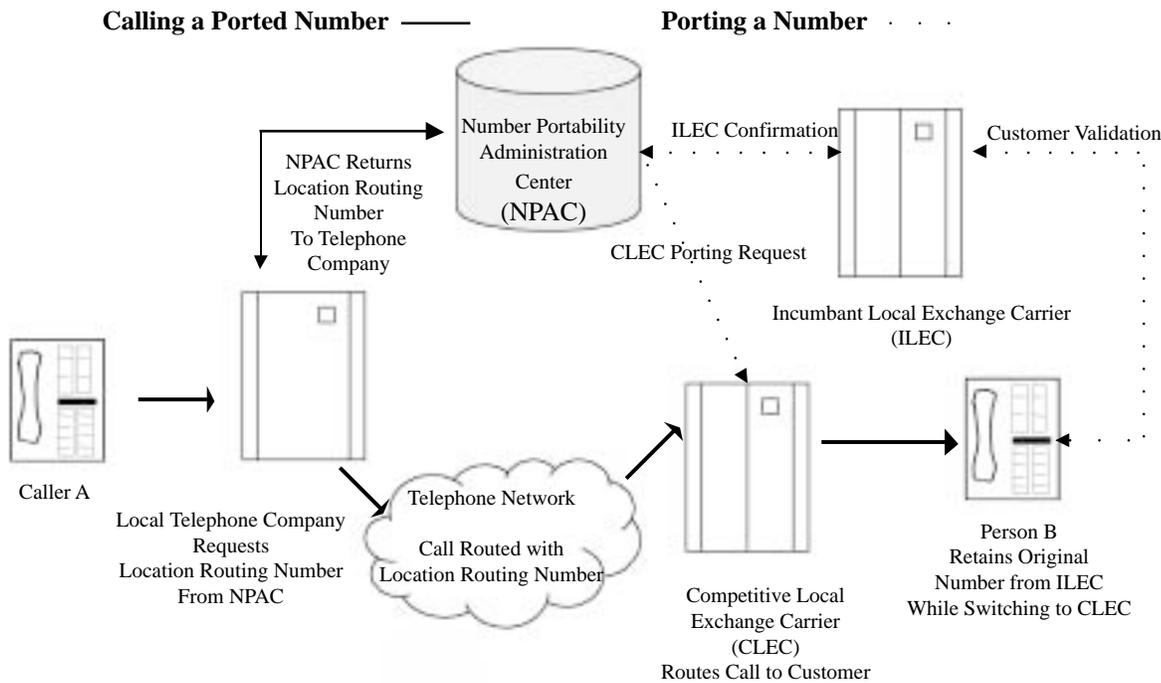


Figure 1. The process of porting a telephone number and the process of calling a ported number.

porting request. The NPAC confirms with the CLEC, ports the number, and changes the NPAC database to reflect the customer's new telephone company (America's Network, 1997). The customer has now changed service providers while retaining their original telephone number.

Once a customer's telephone number has been ported to a CLEC, the telephone number they have retained will no longer be utilized to route a call on the telephone network. When calling a person who has been ported to a CLEC, the caller will use the telephone number they have always used. However, network routing will now be completed with a location routing number instead of the original telephone number. The following describes how a telephone call would work to a ported customer (Refer to Figure 1). First, a caller ('A') dials

the telephone number of a person ('B') whose number has been ported to a CLEC. Caller 'A' dials the original telephone number he/she has always used to contact person 'B'. Second, caller 'A's' telephone company determines from routing tables that the number dialed is a ported number. The call asks the NPAC database to locate the initial routing number of the ported number. Third, the NPAC searches, utilizing the telephone number dialed to reach person 'B'. When a match is found, the corresponding location routing number is returned to caller 'A's' telephone company. Fourth, caller 'A's' telephone company uses the location routing number to send the call across the telephone network. Eventually, as more individuals change local telephone company service providers, all telephone calls will require NPAC database

inquiries (Midwest Region Number Portability Administration Center, n.d.).

And the Future?

Should implementation of local number portability be successful, the new competitive telecommunications marketplace will eventually offer a variety of new services at lower prices to consumers eager to try new technologies. Implementation of local number portability means that all telecommunications service providers will have to compete with one another on the basis of quality, price, and type of service. Local number portability levels the playing field, allowing consumers to choose the desired services from the desired providers at the desired price. When new services are created, consumers can simply request a change in service provider while retaining their

original telephone number. Through competition, systems will be developed that eliminate the need for multiple telephone numbers, saving the North American numbering plan. This new system will allow individuals to communicate whenever, and wherever, with only one network address, which will serve as cellular, landline, Internet, and fax number.

Competition and limited regulation proves to be the best motivator for technological innovation within telecommunications. Still in its infancy, the Internet has been free to develop in absence of regulatory control. The FCC has repeatedly stated that the Internet should develop

in a competitive market (Kennard, 1999). This competitive environment is creating a myriad of new technologies such as Internet telephony, web radio broadcasts, and online e-commerce. However, if a regulatory environment pervades the Internet, technological innovation which benefit consumers will decrease just as it did for several decades in the telephone industry.

The new telephone industry will truly be competitive once local number portability is implemented. The new telecommunications service provider will have to discard a monopolistic mindset and think in terms of customer service and technologically advanced. While there will be

more unique services available in the future, the smartest consumers will benefit the most they will choose wisely from all the available options. The most important issue, however, is how long the telecommunications industry will remain competitive. Rapid technological development in a competitive market may create more societal problems than benefits, requiring additional regulatory control, just like the early days of the telephone.

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