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**The Historical Foundations of Communications Regulation**

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# THE HISTORICAL FOUNDATIONS OF COMMUNICATIONS REGULATION

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August 2008

## Abstract

This paper, written for a conference at the University of Lisbon, surveys patterns since the 16th century in the governance of communications service providers -- in order, the mails, telegraphy, the telephone, and radio. It analyzes the tendency for many communications service enterprises to be publicly-owned and identifies reasons for the exceptions. Tasks subject to either public control or regulation are identified -- e.g., route structure, pricing, patent stalemates, technological standards, physical interfaces and interoperability, electromagnetic spectrum allocation, and the privacy of communications.

# THE HISTORICAL FOUNDATIONS OF COMMUNICATIONS REGULATION

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August 2008 Revision

Doug Rosenthal asked me to provide a brief overview of the historical roots of radio and telephone governance as lessons for regulation of the Internet. I found this a challenging assignment, since the roots go deeper, back to the early postal systems and emergence of the telegraph as antecedents to radio and the telephone. So my survey sweeps wider.<sup>1</sup>

## Natural Monopoly?

It would be too much to insist that early postal and telegraph systems were natural monopolies in the economist's strict sense, i.e., that a single supplier could carry out the desired level of business at lower costs than multiple firms. Proving natural monopoly is difficult. Even AT&T, supported by a small army of first-rate econometricians, was unable in its antitrust case during the 1970s convincingly to demonstrate its long-held belief that it was a natural monopoly. But what is clear is that some hallmarks of natural monopoly -- notably, economies of scale -- were present historically.

An important feature of postal service has always been the availability of service on a dependable schedule. At the modest volumes of mail carried between major cities during the 15th through the 18th centuries, this meant that average costs would be higher if trunkline operations on a given scheduled route were divided among two or more carriers than with a single carrier. There were advantages too of rapid and seamless coordination, if not within a single provider, then between a small number of providers -- as the mail moved from one junction point onto a different route. And even today, the "last mile" -- daily delivery of non-express mail from local post offices to individual residences (sustained widely only since the 19th Century) -- is considered to approximate natural monopoly because duplication of routes

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1 . A variety of sources, both general and specific, has been tapped. General sources on early forms of communication include the magnificent 1910 (eleventh) edition of the Encyclopaedia Britannica; Germany's more recent (1982) Brockhaus Lexikon; and the 2003 Oxford Encyclopedia of Economic History. Other sources will be identified as they are used.

would be more costly.

For electrical means of communication such as the telegraph and landline-based telephone, costs tended similarly to be higher when cables were duplicated by competing providers, both for the last mile and on lower-volume trunklines.

The tendency toward monopoly structures in mail and later electrical communication systems meant that monopoly prices might be charged. Since at least the 17th century in England, there was aversion to private monopolies and the prices to which they gave rise. Among other things, the availability of communications at modest prices was believed to foster commerce and hence to help build national strength. And for the infant United States, speedy and reliable communications were an important element of nation-building. As Thomas Jefferson wrote to John Adams in 1777:<sup>2</sup>

I wish the regulation of the post office adopted by the Congress last September could be put in practice. It was for the riders to travel night and day, and go their several stages three times a week. The speedy and frequent communication of intelligence is really of great consequence. ... Our people merely for want of intelligence which they may rely on are become lethargick and insensible of the state they are in.

To combat abuses of monopoly positions, nations and in some cases local governments intervened to regulate prices and often to make the relevant service providers state-owned or state-controlled enterprises. For postal services, state-owned monopoly eventually became the norm throughout most of the developed world. For telegraph and telephone, a more mixed approach is observed -- emphasizing state monopoly in much of Europe, but with more reliance on private enterprises in the emerging United States. We demonstrate this by providing brief organizational histories.

## Postal Service

Regular and systematic postal service available to the general public can be dated back to the 15th century. An early trace was a 1464 decree by

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2 . Lester J. Capon, ed., The Adams-Jefferson Letters (University of North Carolina Press: 1959), vol. I, pp. 4-5.

King Louis XI, granting to a nobleman an exclusive "privilege" to provide postal service in France. In the Habsburg empire, Prince Franz von Taxis began regular postal service between Vienna and Brussels in 1495. He then extended his operations to other parts of the Habsburg domain, and in 1516 Emperor Karl V granted the Thurn and Taxis family a monopoly privilege to operate postal service throughout the empire, reaching as far as Spain. The empire was fragmented and the emperor's power was undermined as a result of the Thirty Years War (1618-48), and individual states began to operate their own postal services within their boundaries. The Napoleonic wars reduced the empire's span of control even more, and in 1803, the Thurn & Taxis privilege was abolished, to be taken over by state-owned postal systems. Coalescence of individual German states under Prussian leadership during the 1860s led to the emergence of a nearly nationwide government-owned Reichspost, although the states of Bavaria and Wuerttemberg maintained locally-owned postal systems separate from that of the Reich until the reorganizations following World War I.<sup>3</sup>

In England and Scotland, systematic postal service was also inaugurated during the late Middle Ages under royal exclusive privilege grants, called "patents" at the time, often for routes that covered only a part of the British land mass. There were frequent infringements on the grants and conflicts that led to the wholesale revocation of grants and their transfer to other parties in better grace with the sovereign. Among other things, there were complaints that postal service in Britain was inferior to the service in other lands by the Thurn and Taxis family, which among other things operated mail service to England from the European continent. In 1635, the Crown first stepped in to prescribe maximum rates on key postal services. At about this time, monopoly patent grants by the Crown came under increasing criticism. They were ruled contrary to common law in the famous 1603 "Case of Monopolies,"<sup>4</sup> and in 1624 Parliament abolished Crown monopolies in principle with a Statute of Monopolies (widely honored in the breach). Postal service grants by the King were debated vigorously in Parliament during the 1640s and eventually abolished. However, new exclusive franchises were issued (i.e. "farmed" out) to private parties by the Postmaster under parliamentary authority. Several reorganizations followed, leading eventually

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3 . See Gustav Stolper et al., The German Economy: 1870 to the Present (Harcourt, Brace & World: 1967), p. 16.

4 . Darcy v. Allein, 11 Coke 84b-88b (1603).

to operation of the postal service under the direct leadership of a Postmaster. Adam Smith, fiercely opposed to government enterprise in most fields, lent grudging approval in 1776.<sup>5</sup>

The post office is properly a mercantile project. The government advances the expence of establishing the different offices, and of buying or hiring the necessary horses or carriages, and is repaid with a large profit by the duties upon what is carried. It is perhaps the only mercantile project which has been successfully managed, I believe, by every sort of government. The capital to be advanced is not very considerable. There is no mystery in the business. The returns are not only certain, but immediate.

The English exclusive franchise "farming out" system was carried over into the American colonies. In 1753 Benjamin Franklin was promoted from postmaster in Philadelphia to co-postmaster for all of the colonies. He introduced many reforms, increased the frequency and speed of service, and by 1761 was able to begin paying substantial profits to the Crown.<sup>6</sup> The outbreak of the American Revolution in 1775 disrupted the Crown-franchised postal system, leading among other things to the interception of American patriots' letters by the British authorities and often to their publication (as traitorous documents) in journals friendly to the Crown. To combat this, the new American government created its own postal service. When the revolution succeeded, continuation of federally-owned postal service was enshrined in Article I, Section 8, of the U.S. Constitution and in the 1792 Post Office Act. In 1790, the first U.S. treasury secretary, Alexander Hamilton, saw profits from the postal service as an important source of revenue for funding the national debt.<sup>7</sup> In 1799 he proposed using postal service profits as collateral for loans to extend the continental road system.<sup>8</sup>

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5 . An Inquiry into the Nature and Causes of the Wealth of Nations (Modern Library edition: 1937), pp. 770-771. See also p. 682.

6 . Esmond Wright, Franklin of Philadelphia (Harvard University Press: 1986), pp. 84-86. In addition to a generous fixed salary, Franklin enjoyed free mailing of the newspapers he published at the time.

7 . Joanne Freeman, ed., Alexander Hamilton Writings (Penguin: 2001), p. 569 (from Hamilton's "Report on Public Credit").

8 . Ibid. p. 917 (in a Memorandum on Measures for Strengthening the Government).

The implication of the U.S. Constitution and the 1792 enabling statute was that the U.S. Post Office would be a monopoly. When railroad networks began to cover the Eastern United States during the 1840s, private express services emerged, using the trains to permit more rapid delivery. The Post Office sought to enjoin their operation as inconsistent with its monopoly franchise. During the 1850s, a vacuum left by the Postal Service on the Pacific Coast was filled by the mail carriage operations of Wells-Fargo. And starting in 1860, the Pony Express offered eight-day service from Missouri to San Francisco until transcontinental telegraph services began in October 1861. An even larger but little-known challenge to the Post Office's public monopoly came in 1906. William D. Boyce, founder of the Boy Scouts of America and publisher of magazines, organized a syndicate with capitalization of \$300 million to privatize the Postal Service. In Congressional testimony he guaranteed that his private enterprise would reduce postage rates by one-half and pay the government all profits on capital in excess of seven percent.<sup>9</sup> The offer was not acted upon by Congress, but Boyce obtained what he really wanted -- a holdback on planned increases in postage rates for his (and others') periodicals. Much later, significant competition was allowed for some products traditionally monopolized by the Post Office -- first with the emergence of package delivery by United Parcel Service, then with the provision of overnight services by Federal Express and others, and most recently, with the shift of considerable commercial correspondence to the Internet. The Postal Service itself was transformed from a department of the U.S. federal government to a state-owned corporation, whose postage rates are controlled by a special Postal Regulatory Commission. The Commission's regulatory powers with respect to "competitive" services were cut back under the Postal Accountability and Enhancement Act of 2006.

A reason for public operation of postal services quite far removed from the logic of scale economies and natural monopoly is the desire of public authorities to monitor the mails and interdict communications posing a potential threat to the public realm. William Shakespeare sets the problem as early as the year 1415, when young King Henry V of England uncovers a conspiracy against him on behalf of France by the Earl of Cambridge, Lord Scoop, and Sir Thomas Grey. Exactly how the plot was discovered is left

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9 . Republican-Times newspaper, Ottawa Old and New: A Complete History of Ottawa, Illinois (1914), p. 136.

unclear, but Shakespeare implies that incriminating letters were intercepted:<sup>10</sup>

Duke of Bedford: The king hath note of all that they intend,  
By interception which they dream not of.

...

Henry: What see you in those papers that you lose  
So much complexion? -- Look ye, how they change!

...

Could out of thee extract one spark of evil  
That might annoy my finger? 'tis so strange,  
That, though the truth of it stands off as gross  
As black and white, my eye will scarcely see it.

The consequence for the "poor miserable wretches" was death.

Interception by the Crown of private letters continued to be a point of contention. The earliest known instance of a solution came in 1710, when an English Parliament seeking to limit the power of the Crown passed legislation allowing government personnel to read letters sent through the Royal Post only with an explicit warrant from the Secretary of State. One infers that such legal niceties were waived in the 1770s, when mail from suspected rebels in America was intercepted and published. As the disputes within the Bush II administration and between the administration and Congress over the tapping of telephonic and internet messages from potential terrorists reveal, the problem continues even to the present.

### Telegraphy

Optical semaphore systems were deployed in the 18th century for communications on which speed was of the essence. The Rothschild banking family enhanced its fortune in 1815 by communicating from Waterloo to London, in part through a semaphore system, the news of Napoleon's defeat hours before pessimistic London Stock Exchange investors learned about the reversal of an earlier setback.

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10 . King Henry V, Act II, Scene II.



As with many inventions, there is some doubt as to who "invented" the telegraph. The ultimately successful design was that of Samuel F. B. Morse in America, whose electromagnetic approach was conceived and patented between 1835 and 1837. Morse's device was first tested on a line between Washington, DC and Baltimore in 1844. In Europe, however, an alternative device patented by Cooke and Wheatstone was tested along railway lines between London's Paddington Station and Slough in 1843. The initial practical exploitation of the new technology was by private companies -- in England, by the Electric Telegraph Company, incorporated in 1846, and then by five other companies; and in the United States, by Western Union and then several other private entities, many affiliated with the railroad lines along which the first telegraph lines were often strung. Morse offered to sell his patents to the U.S. Post Office, but the offer was turned down, and so telegraphy became and remained a private enterprise in the United States. Incorporated in 1851, Western Union absorbed other telegraph companies and came to dominate the U.S. industry, buying out its last large rival in 1887.

In Europe the industry's evolution was quite different. France, Switzerland, Belgium, and Prussia among others moved quickly to state ownership of telegraphic services under their Post Offices. Observing the continental experience, commercial and government interests in Great Britain began in 1856 a campaign to nationalize the telegraph companies and place them under the Post Office. A report by a Post Office official alleged that:<sup>11</sup>

... the charges made by the telegraph companies were too high and tended to check the growth of telegraphy; that there were frequent delays of messages; that many important districts were unprovided with facilities; that in many places the telegraph office was inconveniently remote from the center of business... and that little or no improvement could be expected so long as the working of the telegraphs was conducted by commercial companies striving chiefly to earn a dividend and engaged in wasteful competition with each other ...

In 1868 the private British companies were nationalized into the Post Office at a price of roughly £5.7 million, with payments to be spread over two decades. Telegraph traffic did rise sharply after nationalization, but the profits were disappointing.

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11 . Encyclopaedia Britannica, 11th ed. (1910), vol. 26, p. 525.

Use of the telegraph soon spread to communications between nations, often through the successful laying of underwater cables beginning with a link across the English Channel in 1851. Most of the early underwater cables were laid by private companies, as was the first transatlantic cable, successfully inaugurated in 1866 by a U.S. - British joint venture, the Atlantic Telegraph Company, after several failed attempts. Some of the short-haul international cable links were nationalized, but most remained privately owned. J. H. Clapham reports that as of 1913, only 18 percent of the 516,000 kilometers of sea cables belonged to state-owned entities, mostly post offices.<sup>12</sup> There were however some important exceptions, notably, a cable between Canada and Australia undertaken by the British government in 1901. The private Eastern Telegraph Company, which had already extended lines from Europe to the Far East, protested this intrusion by the Imperial government into a field that had already attracted considerable private capital. The Colonial Office responded:<sup>13</sup>

With the progressive development of society the tendency is to enlarge the functions and widen the sphere of action of the central government as well as of the local authorities, and to claim for them a more or less exclusive use of powers, and the performance of services where the desired result is difficult to attain through private enterprise, or where the result of entrusting such powers or services to private enterprise would be detrimental to the public interest, through their being in that event necessarily conducted primarily for the benefit of the undertakers rather than of the public. This tendency is specially manifested in cases where from the magnitude or other conditions of the enterprise the public is deprived of the important safeguard of unrestricted competition....

And so the nationalized program went forward.

The rapid spread of telegraphy required a standardized language through which electrical devices could communicate. Morse Code became the accepted standard, undoubtedly as a consequence of Western Union's first

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12 . The Economic Development of France and Germany, 1815-1914 (Cambridge University Press: 1951), p. 363.

13 . Encyclopaedia Britannica, vol. 26, p. 528.

mover advantage. When international telegraph lines were laid, Morse Code was adapted in 1851 to accommodate the diacritical marks used in languages other than English. The need for standardization and coordination of interfaces persisted, and in 1865 the International Telegraph Union was created to act as a standards coordination agent. It continues to function even today as the International Telecommunication Union, with offices on the Place des Nations in Geneva.

## Telephony

The advent of the telephone in the late 19th Century posed new public policy problems. There were economies of scale in extending wires to customers, especially for "the last mile," driving market structures toward either monopoly or in a few cases duopoly. In Europe the predominant solution was to incorporate telephone networks into the existing postal and telegraph monopoly, giving rise to the acronym PTT (for post - telegraph - telephone enterprises). In the United States the industry's development was led by private companies. From an early date, state agencies regulated telephone service prices (i.e., rates) within their local jurisdictions. In 1910 the Interstate Commerce Commission, created in 1887 to regulate railroads, was given responsibility for regulating interstate facets of the U.S. telephone industry, but it did so lackadaisically. In 1934 responsibility for interstate regulation was transferred to a new Federal Communications Commission, which addressed its difficult tasks somewhat more effectively but was eventually overwhelmed by the technological complexity of its mandate.

Unlike postal service but like the telegraph, invention patents assumed an important role in the industry's early history. Patent applications for what proved to be key inventions were filed on the same day in 1876 by Alexander Graham Bell, an independent inventor, and Elisha Gray, an employee of Western Electric, Western Union's telegraph equipment manufacturing subsidiary. Bell and Western Union settled their patent disputes in 1879, with Bell's commercial entities taking over Western Electric's patents and its local telephone service activities while the Bell companies agreed to stay out of Western Union's telegraph business. At the time, antitrust in the United States was at first non-existent and then weak. Under precedents developed during the second half of the 20th Century, the field-delineating agreements would almost surely have been declared illegal.

Many additional private companies entered the telephone service business in America, most commonly in urban areas in which the Bell System had not yet issued franchises. Bell's basic patents were upheld by the U.S. Supreme Court in 1888, and the Bell companies sued many of the new operators for infringement of telephone concept and equipment patents. They were successful in many of these suits, but non-Bell companies continued to proliferate, especially after the basic Bell invention patents expired. In 1902, 1.32 million Bell telephones were in use and 1.05 million phones had been installed by non-Bell companies.<sup>14</sup>

Early private company telephone operations in the United States focused on serving local areas. But advances in electrical and then electronic technology permitted the establishment of inter-city connections. The Bell companies were nearly alone in having the scale and technology to operate these so-called "long lines." For the Bell companies, being able to interconnect subscribers in a particular city with subscribers in other cities was a major advantage, enhancing the value of telephone service to users in a kind of network effect.<sup>15</sup> Bell in turn systematically denied interconnection to subscribers of the non-Bell companies, putting the rivals at a competitive disadvantage and enhancing their willingness to be taken over by the Bell System. Eventually this strategy was attacked by the U.S. federal antitrust authorities, and in 1913 Bell negotiated with the government the so-called Kingsbury commitment, agreeing to interconnect its inter-city and local facilities with independent companies if they adhered to interconnection standards set by Bell and to limit Bell's acquisition of non-Bell telephone service companies. However, Bell continued to achieve leverage from its unique inter-city facilities by setting high prices for interconnection. Regulation of this important interface problem was performed after 1934 by the Federal Communications Commission. In Europe, of course, the interconnection problem was minimized because there was only one

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14 . Much of this account is drawn from F. M. Scherer, "Technological Innovation and Monopolization," forthcoming in W. D. Collins, ed., Issues in Competition Law and Policy (American Bar Association).

15 . See M. L. Katz and Carl Shapiro, "Systems Competition and Network Effects," Journal of Economic Perspectives, Spring 1994, pp. 93-115.

integrated telephone service provider in a given nation, namely, the state-owned monopoly. Setting the prices for "hand-offs" from one national provider to another at home in another European nation has continued to be a problem, addressed by the European competition policy authorities for cellular telephones in 2006.

## Radio

The invention of radio led to industrial applications that posed new and difficult challenges for regulators. The first non-experimental use of radio was to transmit and receive primitive telegraphic messages. In 1901, Guglielmo Marconi achieved the first successful trans-Atlantic communications and began establishing radio service companies in European nations and the United States. Other private companies entered the field, but on the strength of their key patent holdings, validated inter alia by the U.S. Supreme Court, the Marconi companies maintained a commanding position.

The first commercial applications of the new radio technology were for ship-to-shore and ship-to-ship communications, of special interest to both shipping lines and national navies. In England, there was heated debate over the relative roles of private companies vs. the government in outfitting and operating radio stations. Private service companies, among others the Marconi Marine Company, entered the field, but so also did the British Post Office. In 1906 the Post Office established its first radio station, and in 1909 it in effect nationalized the principal ship-to-shore land stations established previously by private companies. However, as the technology became more complex, it overstrained the Post Office staff's technical competence, and so in 1912 the Post Office contracted with Marconi to construct its "imperial chain" of stations. The compensation to Marconi was a front-end lump sum plus running royalties.<sup>16</sup>

The entry of the United States into World War I triggered fears that conflicting patent stalemates might hold back the development of radio communications essential to the war effort. Marconi's patents, among others, were forced into a patent pool eventually managed by the newly-formed Radio

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<sup>16</sup> . See S. G. Sturmev, The Economic Development of Radio (Duckworth: 1958), especially pp. 88-92.

Corporation of America and shared by a number of other private companies.<sup>17</sup>

The extension of radio technology to voice communications and then broadcasting posed additional patent problems. Voice radio required a wider array of electronic oscillators and other tubes, including J.A. Fleming's thermionic valve, Reginald Fessenden's alternator, and Lee de Forest's triode, and as a consequence increased the number of patent-holding interests and the problem of mutual blockage. In the United States the problem was solved privately through patent-pooling, but the pool arrangements allocated exclusive spheres of interest to participating companies and eventually induced intervention by the antitrust authorities.<sup>18</sup>

As World War I ended, two new uses of radio spread: "ham" operations in which private amateurs communicated with each other by radio, using first Morse Code and then voice messaging; and the broadcasting of news, music, and drama by local radio stations. Both new applications raised the threat of mutual interference at any given radio frequency, and so a system was needed to allocate frequencies or frequency bands to individual users. The interference problem was first addressed at an international conference in 1906, leading in the United States first to the Wireless Ship Act of 1910 and then, in 1912, to a Radio Act requiring all radio broadcasters, including ham operators, to obtain licenses and frequency allocations from the U.S. Department of Commerce. In 1927 the licensing task was transferred to a new Federal Radio Commission, whose duties in turn were absorbed in 1934 by the Federal Communications Commission. In Great Britain the task of issuing radio licenses was undertaken by the Post Office which, we have seen, was also actively engaged in point-to-point service operations. Coordination of frequency assignments at the international level was also necessary. The task was taken over by the International Broadcasting Union, established in 1925 and later absorbed into the International Telecommunication Union, whose origin, we have seen, was the International Telegraph Union of 1865.

In the United States there was litigation over the role of the Secretary of Commerce in making frequency allocations. Among other things, it was argued that early radio stations had secured first-mover property rights to the

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17 . See U.S. Federal Communications Commission, staff report, Report on Telephone Investigation (two volumes, mimeo, 1939), vol. I, pp. 330-331.

18 . See Scherer, "Technological Innovation and Monopolization," supra note 14.

radio frequencies on which they began broadcasting. This problem was resolved in the Radio Act of 1927, but the idea of property rights in the radio frequency spectrum, with allocations being exchanged in market transactions, was advanced in a seminal article by Ronald Coase.<sup>19</sup> At first Coase's proposals gained little ground, but beginning in the 1980s, they became the foundation of new methods for allocating the spectrum in both the United States and Europe. To be sure, national governments and the International Telecommunication Union had to determine what portions of the spectrum were available for each of many possible uses. But once use allocations were settled, segments of the spectrum could be auctioned off by government to private parties, after which winning bidders obtained property rights and could trade their spectrum allocations further in a free market.

Broadcasting of radio programs to potentially broad consumer audiences began in the early 1920s. Here too, the role of government had to be determined. In the United States, the government allocated radio spectrum to private entities, who were then entitled, with only mild restrictions, to broadcast what they chose and to finance their broadcasting by selling advertising. The first commercial station was Westinghouse's KDKA in Pittsburgh, commencing operations in 1920. There were apprehensions from early on about the desirability of financing the new communications medium through advertising sales. U.S. Secretary of Commerce Herbert Hoover, for example, observed in 1924:<sup>20</sup>

I believe the quickest way to kill broadcasting would be to use it for direct advertising. The reader of the newspaper has an option whether he will read an ad or not, but if a speech by the President is to be used as the meat in a sandwich of two patent medicine advertisements, there will be no radio left.

Nevertheless, Mr. Hoover was forced as U.S. president beginning in 1929 to sandwich his radio broadcasts among advertisements. And of course, he was wrong on the commercial sustainability of radio, despite incessant complaints

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19 . "The Federal Communications Commission," Journal of Law & Economics, October 1959, pp. 1-40.

20 . From Sylvia Harvey, "Radio and Television Industry: Industrial Organization and Regulation," The Oxford Encyclopedia of Economic History (Oxford University Press: 2003), vol. 4, p. 328.

that the need to maximize advertising revenues by appealing to a low common denominator would lead to broadcasts of minimal quality -- in the May 1961 words of FCC chairman Newton Minow, to a "vast wasteland" of content.

In the United Kingdom, the debate followed a different vector. In 1922, the Post Office was confronted with applications from 24 companies seeking licenses to commence radio broadcasting. This was too many, government officials argued, and eventually, to avoid among other things a "chaos of the ether" with many stations financing themselves through advertising, the British Broadcasting Company was created. At first BBC was owned by six radio equipment manufacturers, with the monolithic BBC being financed by tariffs on sales of equipment to radio listeners and later by an annual fee imposed upon listeners.<sup>21</sup> In 1927, however, the private interests were bought out and BBC was established as a state-owned corporation with a mandate to sustain high-quality broadcasting. The nationalized BBC broadcasting approach became the norm, with occasional private exceptions, in the rest of Europe. During the decades following World War II, however, the all-public-radio (and television) approach was relaxed, and licenses were issued to private parties broadcasting alongside the nationalized stations and financing their radio or television programs by selling advertising. And in the United States, a publicly-owned radio and television broadcasting entity, the Public Broadcasting System (PBS), was established in 1967 to broadcast high-quality and public-interest programming with financing from the federal government along with listener donations. Thus, in much of the world, a variable mixture of public and private ownership now prevails.

## Conclusion

To sum up, the evolution of communications technology has posed many problems concerning the optimal interface between business and government. Quite generally, there has been continuing debate over the relative roles of private companies vs. government enterprises in providing communications service. And especially when private operation has been favored, several

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21 . As a resident of Germany during the early 1970s, I often wondered how the public broadcasting authorities could tell whether we were in fact watching television or listening to radio, so that we were required to pay the fee. In an analysis of radio signal espionage I learned the answer -- one could from a distance through induction listen to the signals being received. It was said that trucks patrolled the streets of Berlin with induction devices, but my impression was that the fee requirement was only weakly enforced.



problems present themselves:

\*One is the traditional problem of natural monopoly or close-knit oligopoly, leading potentially to elevated prices and restricted service. Some kind of price regulation to maintain "reasonable" prices has often been imposed. And for content that is broadcast, which in effect becomes a public good, appropriate means of revenue-raising to cover costs must be worked out.

\*Second, as technology advances, conflicting patent claims, if not settled amicably, may require government intervention to break stalemates and ensure rapid and widespread diffusion of the best techniques.

\*Third, because communications systems, and especially those based upon electricity and electronics, must interoperate, some authoritative body must set interface standards and resolve language encoding disputes.

\*Fourth, not only must the technology for interoperability exist, but firms operating in one geographic or product spectrum segment must be induced to cooperate with others in the mutual transmission and receiving of communication signals. Interconnection fees must be set at reasonable and non-discriminatory levels.

\*Fifth, scarce resources, and especially the electromagnetic spectrum, must be allocated among competing users in a way that avoids interference and fosters efficient utilization.

\*And finally, governments may have to intervene, and to restrain their own actions, to ensure that communicated messages are treated confidentially, subject to only the most compelling exceptions.