

## Introduction

FLICK A SWITCH, THE LIGHT COMES ON; TURN A FAUCET, water flows; touch a remote, a cable television program appears. These are mundane acts. Yet the construction and the elaboration of the fixed networks over which these kinds of services are delivered have been among the greatest—and one of the most problematical—human endeavors of the last 150 years. In ubiquitous ways easily taken for granted, networked systems of electric power and lighting, piped-in water, telecommunications, and media delivery are now woven into the very fabric of our day-to-day lives. Our growing use of these systems to carry out even the most intimate functions of our lives—to communicate and cooperate with one another, to exercise authority over one another, to produce and distribute a wide range of goods and services—constitutes one of the major ways in which our lives differ from those of our ancestors.

This book is about some of the political and regulatory tensions and dilemmas that have arisen from our growing reliance upon fixed networks for the provision of different goods and services. As shall be seen, there is a stubbornly protean quality about the issues. Resolve the tensions in one guise, they promptly appear in another—tied at the hip, most likely, to whatever solution has been chosen and leering gleefully. This is not, however, a counsel of despair. Conscious human choice and hard-fought human struggles have mattered in the past and continue to do so. Decisions about ownership and regulatory arrangements and choices

about the shapes of technologies themselves can and do affect outcomes.

I explore the issues as they have played out over time in three different networked systems in the United States—waterworks, electric utilities, and cable television. I selected these three for investigation not just because of their significance in and of themselves but also because of possibilities for fruitful comparison. The aim is to leave the reader with a richer understanding both of the character of the political and regulatory puzzles presented by these kinds of systems and of the strengths and weaknesses of different approaches to addressing the problems.

Patterns of similarity and variation are of central concern. Although waterworks, electric utility, and cable television systems are obviously far from identical with one another, they do have major characteristics in common. The three are akin in that they all consist, at least in part, of fixed networks of pipes or wires to which consumers are physically linked. Ways in which the three have historically been employed also bear something of a family resemblance to one another. As distinguished from telephone and computer networks designed to facilitate contact between users, they have thus far been developed primarily as instruments for the one-way delivery of services. That is, products such as water, electricity, or television programs flow one way through the networks from a relatively small number of producers to a relatively large number of consumers. Furthermore, waterworks, electric utilities, and cable television systems alike have all been viewed at times as playing important public roles in society.

Amid these and other commonalties, however, much variation can also be discerned. Technologically, for example, the pipes, pumps, and reservoirs that make up a municipal waterworks differ in obvious ways from the satellite down links, coaxial cable, and other electronic components that make up a modern urban cable television system. Products and services furnished over the networks have also varied. Specific public services demanded, for example, have ranged from fire protection and public health in the case of waterworks, to street lighting and cheap power for economic development in the case of electric utilities, to public access channels and diverse noncommercial programming in the case of cable television.

Patterns of system development, ownership, and regulation over time have also been characterized by variation amid common themes.

Early construction and elaboration of waterworks, electric utility, and cable television systems took place in very different historical settings. In the case of waterworks, private firms and municipal governments built systems throughout the nineteenth century as cities developed and grew in size. During this period, waterworks represented a critical element in a distinctively growth-oriented American style of city-building, elements of which have survived to the present day. The first small electric lighting systems, by contrast, began to be put in place in American cities only during the 1880s. The blossoming of such systems into full-fledged multipurpose urban and regional electric utility networks is really a phenomenon of the first decades of the twentieth century.

The historical setting for cable television is different yet again. Development of cable television in the United States began during the years following World War II, with construction of systems in major cities taking place largely during the 1970s and 1980s. Viewed broadly, however, cable television systems represent but one relatively new element in a fluid and shifting ensemble of over-the-air as well as wired technologies that have been used for delivery of media “products” over the past one hundred years. Hence the history of cable television can be properly understood only in the context of its closely related over-the-air counterpart and of broader trends in media and mass communications.

Although early waterworks, electric utility, and cable television development took place in very different historical settings, the initial forms of ownership and regulation bore remarkable resemblance to one another. At the outset, nongovernmental ownership predominated in all three industries. As of 1800, private firms owned fifteen of the sixteen waterworks then operating in the United States. Likewise, during the 1880s and 1890s, private firms also built and operated the vast majority of pioneering electric lighting systems in American cities under the terms of municipal franchising arrangements and street lighting contracts. In cable television during the 1950s and 1960s, the pattern was similar. Private firms developed the first systems under franchise arrangements eerily akin to those employed in both waterworks and electric utilities decades before.

As each industry developed, however, patterns of ownership and regulation increasingly diverged. In the case of waterworks, municipal governments in the largest and most rapidly growing of American cities

consistently made the decision to invest the large sums of money needed to purchase and/or construct their own waterworks. By 1897, as a consequence, municipally owned waterworks served all but nine of the fifty largest cities in the United States. In electric utilities, too, municipalities or other governmental entities sometimes built or acquired their own systems. With important exceptions, however, government ownership campaigns went down to defeat in most major cities and private ownership has continued to predominate. In cable television, government ownership initiatives made even less headway. As a consequence, almost all cable television systems in the United States remain under private ownership.

If waterworks, electric utility, and cable television systems were either totally identical with one another or completely different, little would be gained by comparing them. Rather, it is the combination of both similarities and differences in technology, patterns of industry development, historical contexts, and public policy that affords analytical leverage otherwise unattainable. To further aid in understanding public policy issues presented by networked systems, I draw inspiration from a diverse array of scholarly traditions. The history of technology and related areas of urban history are of particular importance. Much recent scholarship in these domains is concerned with the roles played by ideas and ideology, social groupings, power relationships, and political and institutional arrangements in shaping or constructing different kinds of technological artifacts and in determining how they are employed in different social contexts. The emphasis is on technology as a cultural, social, or political product rather than its effects on society.

Historian Mark Rose, for example, identifies a number of contexts that shaped the development of gas and electric utility systems in American cities and that played roles in inspiring increased demands for service. Important contexts identified by Rose include municipal politics, urban and suburban growth, and the activities of a range of actors, including “educators, home builders, architects, and the executives and salespersons who worked for the great gas and electric corporations.” Such “agents of technological diffusion,” according to Rose, “defined gas and electricity as part of the effort of Americans to enhance comfort and convenience; and nearly as often, agents of technological diffusion

defined appliances as appropriate for men or women, but never for both.”<sup>1</sup>

Rose asserts, as do other historians including Thomas P. Hughes and David Nye, that the basis for subsequent patterns of electric utility development had been set by the end of the 1920s. By contrast, Ronald Tobey highlights the importance of political changes during the 1930s in determining roles played by electrical appliances in day-to-day life. He argues convincingly that New Deal initiatives in housing finance and in electric utility ownership and regulation played key roles in laying the groundwork for mass home electrification and modernization during the decades that followed. For all but the most affluent, Tobey declares, “electrical modernization resulted directly from the New Deal’s transformation of the nation’s homes.”<sup>2</sup>

Such quarrels notwithstanding, historians of technology and urban historians generally agree that the shaping of any technological system cannot be understood without reference to a multitude of ideological, social, and political factors and contexts. Many scholars today also share a primary concern with the shaping of different technologies—and an implicit belief in the malleability of technological artifacts themselves. This emphasis has greatly enriched our understanding of why things (quite literally) are the way they are. It has also been a useful corrective to older and more deterministic views of technological change as a kind of inexorable force to which institutions and societies must and should somehow adapt themselves, or fall by the wayside.<sup>3</sup>

At the same time, focusing solely on the social and political construction of different technologies may leave important questions unanswered, even unasked. As philosopher of technology Langdon Winner has pointed out, technological artifacts may sometimes have political and institutional effects *irrespective* of the intentions of the actors involved. There may be ways “in which the intractable properties of certain kinds of technology are strongly, perhaps unavoidably, linked to particular institutionalized patterns of power and authority. Here the initial choice about whether or not to adopt something is decisive in regard to its consequences.”<sup>4</sup>

Fortunately, some historians of technology and urban historians have remained committed to teasing out political and institutional con-

sequences of particular technological choices. In the case of networks in particular, a number of historians have observed relationships between development of systems and dominance by centrally controlled and hierarchically structured organizations. Functional requirements of the technologies themselves are commonly cited as a cause.

In the case of New York City's Croton Aqueduct and Waterworks, for example, historian Joanne Abel Goldman states that "construction of the aqueduct itself mandated the creation of a centralized mechanism for its management, the Water Commission, which evolved as a well-defined managerial infrastructure with 'technical experts' in key decision-making positions."<sup>5</sup> Similarly, according to business historian Alfred Dupont Chandler, demands for coordination over broad geographic areas and "the requirements of high-volume, high-speed operations" resulted in a few large firms gaining control over nineteenth-century telegraph and telephone networks.<sup>6</sup>

Relatedly, the sheer physical durability of the artifacts that make up networks can have institutional and organizational consequences. Historian Thomas P. Hughes, for example, notes that large-scale technological systems such as electric utility networks are human creations, shaped by individual inventiveness and a wide range of political, social, economic, and geographical factors. Once such a system is in place, however, "durable physical artifacts project into the future the socially constructed characteristics acquired in the past when they were designed."<sup>7</sup> Over time, such momentum is likely to be reinforced by the interests and mind-sets of the increasingly large number of people and organizations committed to system development. Thus, "manufacturing corporations, public and private utilities, industrial and government research laboratories, investment and banking houses, sections of technical and scientific societies, departments in educational institutions, and regulatory bodies," according to Hughes, all "add greatly to the momentum of modern electric light and power systems."<sup>8</sup>

Values and mind-sets engendered through involvement in the development of such systems may even take on something of a life of their own. Reasoning along these lines, historian Joel Tarr has postulated that the developing technology of large-scale, capital-intensive sewerage systems in American cities "itself shaped and reinforced other values." According to Tarr, "a belief in the need for planning expertise, bureau-

crazy, and centralization in government, as well as for an expanded state regulatory role, were all supported by the technology.”<sup>9</sup>

To summarize, the history of technology teaches us that forms taken by networked systems or other technological artifacts cannot be understood without reference to the societies in which they are embedded. And that technology does not predetermine many aspects of how such systems have been developed. It is people who make choices and struggle with one another over how systems are to be designed, built, and used. Yet these choices and struggles over technology matter in part because attributes of systems do have political and institutional consequences. For networks to function properly or even to be built at all, large-scale and centralized financing, management, and control may be required. Because of the physical durability of components themselves and aggregations of interests invested in system development, choices made at one moment in time concerning a given technology may powerfully constrain future options.

Additional insights into political and regulatory issues presented by networked systems can be gleaned from a discipline quite different from that of history—economics. Simple concepts derived from economic theory are used here to help in understanding such questions as: What is it that is so specifically “public” about some of the goods and services that are furnished over waterworks, electric utilities, and cable television systems alike? And why is it that issues of monopolistic and centralized economic and political power have arisen so stubbornly and consistently in association with the development of these systems? Economics also helps in understanding the workings of various public policies devised to address these issues in different historical settings.

Historians are often inclined to be wary of relying on the sort of reasoning from assumptions that is characteristic of much economic analysis.<sup>10</sup> History, after all, is primarily concerned with questions of “what actually happened” at different times and places in the past. Carefully and sensitively deployed, however, theoretical insights developed by economists and other social scientists can be used to increase our understanding of situations and problems faced by people in the past. Furthermore, the benefits of bringing the disciplines together are mutual. The very attributes of historical inquiry that distinguish it from economic theory making—its close attention to specific and contingent realities of

local circumstance, human motivation, and processes of change over time—can aid the economist in developing, refining, and testing more general hypotheses.

From an economic perspective, public policy issues presented by networked systems can be viewed as problems of incentives gone awry and market failure. In the ideal world of freely and perfectly competitive markets posited by neoclassical economists, the pursuit of self-interest has benign consequences. Exchanges among numerous buyers and sellers set price and output levels and the “invisible hand” of the market suffices to ensure that the good of all is served. Neither altruism on the part of participants nor regulation from outside is needed. With networked systems that provide diffuse public benefits or raise property values over broad areas, by contrast, matters may be different. In this kind of situation, economic theory suggests, market forces may not suffice to ensure optimal levels of provision and some form of governmental intervention may be needed. A waterworks, for example, may afford a residence or business great benefits and higher property values in ways virtually unrelated to the actual quantity of water consumed. If dependent on user fees alone, a private firm may have little incentive to make the investments required to furnish proper provision even if the benefits to society as a whole far exceed the costs. With respect to public goods of this kind, even many of those who celebrate the wonders of a market economy acknowledge that some form of governmental subsidy or public provision may be justified.<sup>11</sup>

Furthermore, the ability of competition to protect consumers against inefficient limitations on output and high prices set by the owners of networked systems may also be restricted. In the language of economics, fixed and specialized networks of pipes and wires manifest “natural monopoly” attributes.<sup>12</sup> Constructing and operating a water main, electrical distribution line, or cable television feed that serves every house on a block is little (if at all) more expensive than building a facility that serves every other house. The result is a dilemma. Competing systems in a given area represent a wasteful duplication of expensive capital facilities that is unlikely to be sustained by profit-seeking enterprises for any length of time.<sup>13</sup> In the absence of competition or some form of regulation, however, the profit motive can be a powerful incentive for exploitation as well as for efficiency.



The technological attributes of networked systems also have consequences for ownership and regulatory approaches designed to provide for public goods and to protect against monopoly exploitation. I derive insights into the character of these relationships from a form of economic theory known as transaction cost analysis. Analysis of transaction costs suggests that shared characteristics of waterworks, electric utility, and cable television systems might be expected to affect the functioning of ownership and regulatory arrangements in consistent ways. Transaction cost analysis also can be used to help in understanding why it has been far more difficult for conflict between private firms and government regulators to be avoided in some situations than in others.

Economist R. H. Coase set forth the fundamental premises of transaction cost analysis in a well-known 1937 paper.<sup>14</sup> Coase asserted that there would be no efficiency justification for the existence of private firms in a market economy if the very act of buying and selling goods did not carry with it difficulties and costs—transaction costs. Types of transaction costs cited by Coase included the costs of determining relevant prices for a particular good or service and the costs of negotiating and concluding separate contracts for each exchange transaction. To render this more concrete if less precise, think about the difference in time and effort required to buy breakfast cereal at the supermarket versus that required to sell or buy a house. In the first case, transaction costs are relatively low—in the second, relatively high.

For business firms, transaction costs issues typically arise in the context of deciding whether it makes more sense to produce a good or service inside an organization or to purchase it from an outside supplier. By producing in-house, a firm may be able to economize on transaction costs. But there may be trade-offs. As anyone who has worked for a large corporation (or read the comic strip “Dilbert”) is aware, costs and inefficiencies can also arise when goods and services are produced and exchanged within organizations. Coase hypothesized that the actual size of private firms in a market economy is determined by relationships between the transaction costs of using the price mechanism in different situations and the marginal costs of internal organization, such as coordination difficulties and poor management.

Subsequent inquiry by economists has focused on gaining a more refined understanding of transaction costs, particularly the relative mer-

its of engaging in transactions in the market, within organizations, or through forms of complex contracting. Much of this inquiry has focused on questions of industrial organization in the private sector, but some of the insights are highly relevant to issues that arise in providing public goods and can help to address natural monopoly dilemmas presented by networked systems. Oliver Williamson's recent elaboration of a transaction cost approach is particularly useful. Williamson stresses the roles played by "transaction-specific assets" in rendering simple forms of market organization ineffective and increasing the relative advantages of complex contracting or vertical integration. Asset specificity can arise in a variety of ways. Transaction-specific assets can take the form of fixed physical facilities tailored to the specific needs of a single buyer by a single seller. More subtly, advantages gained through "learning by doing" and through the development of personal relationships between buyers and sellers also constitute forms of asset specificity.<sup>15</sup>

The networks of pipes and wires that make up waterworks, electric utility, and cable television systems represent archetypal examples of what Williamson means by a transaction-specific asset. The facilities are fixed, long-lived, and location-specific. Once put in place, it is generally not feasible at reasonable cost to move such assets as buried water mains or an electricity distribution system for use elsewhere. The result is to limit the effectiveness of contracting and franchising approaches, which are otherwise promising, in that they offer the advantages of competition without the costs and inefficiencies of duplicating physical networks of pipes and wires on the ground. The basic principle involved is simple and rather elegant. In its ideal form, contracting or franchising involves private firms bidding for the right to be the monopoly supplier of a good. The firm that offers the best price and service terms wins the bidding competition. By competing for the contract or franchise to supply the good rather than competing directly in the good's production, market discipline would seem to be preserved without wasteful and unsustainable duplication of capital investment.<sup>16</sup>

Williamson allows that such competition may be viable at the outset under some conditions. Once networks of pipes and wires or other transaction-specific assets are put in place, however, a "fundamental transformation" occurs and rival firms can no longer vie for contracts or franchises on an equal basis. Instead, winners of initial bidding contests

enjoy advantages over nonwinners and “what was a large numbers bidding condition at the outset is effectively transformed into [a relationship] of bilateral supply thereafter.”<sup>17</sup> To the extent that such a fundamental transformation takes place, government agencies can not rely upon new bidding contests to ensure that contractors and franchisees fulfill commitments made at the outset. Nor can market forces be easily brought to bear if initially agreed-upon arrangements need to be modified to accommodate changing conditions.

In addition, private firms and government agencies each may have points of vulnerability that can be exploited by the other for bargaining leverage. Private firms may face risks of exploitation and even outright expropriation once large investments are tied up in fixed facilities. Unlike the owner of a fleet of garbage trucks, for example, a private waterworks, electric utility, or cable television firm cannot easily “pick up” its network and install it elsewhere. Therefore, even if an oversight agency sets a price at a level less than that needed to cover both fixed and variable costs, a private firm may find that it has little alternative but to continue to provide service if it is to receive any revenues at all. Government agencies, for their part, face risks because private firms control network operations and future investment. A waterworks firm, for example, might refuse to extend service to a growing area of a city unless it receives a higher price for its product or franchise or contract concessions. Moreover, these areas of vulnerability and bargaining power do not necessarily balance one another in a stable or equitable fashion. Instead, efforts by one or both sides to defend against perceived opportunistic behavior on the part of the other may result in a stalemate that serves the interests of neither and prevents any needed investment. A private firm, for example, might refuse to invest in new facilities because it fears that government regulators may provide inadequate compensation in the future. At the same time, government regulators may be reluctant to make such guarantees because of fears that a private firm will reap monopoly profits.<sup>18</sup>

The picture, however, is not entirely grim. Concepts derived from economic theory and transaction cost approaches also suggest factors that can affect outcomes and ways in which public policy choices can make a difference. In this regard, the concept of natural monopoly needs to be used with care. Forms of market discipline may be present

even in situations in which there is natural monopoly. Under some conditions, inter-product competition can serve as a check on the ability of network owners to exploit their position as sole service provider. In many of the markets served by electric utility firms, for example, manufactured and natural gas has repeatedly waxed and waned as a competitive factor over the years. Similarly, cable television systems today face direct competition from direct broadcast satellite systems of a kind not present twenty years ago.

The willingness of consumers to simply forego purchase of a good or service if prices are raised too high can also serve as a check on monopolistic exploitation by network owners. Should competition from satellites disappear, for example, a cable television system might find it profitable to raise prices of premium channels such as HBO from ten dollars per month to twenty-five dollars. Few consumers, however, would be willing to pay a thousand dollars per day for such a channel and a price increase of this magnitude would almost certainly not prove profitable no matter how secure the cable system's monopoly.

Transaction cost analysis suggests additional factors that can shape the efficacy of forms of government involvement irrespective of roles played by market discipline. Such analysis suggests that the quality of information available to decision makers can play a major role in determining how challenging it is to structure working relationships between government agencies and private network owners.<sup>19</sup> In regard to costs, expenses, and profits, private firms are likely to enjoy an informational advantage. Private network owners, unlike government regulators, can easily draw on knowledge of costs and expenses gained in the course of simply managing the business. Even if a government agency has the legal authority to audit claims made by a private firm, difficulties in gaining access to information and analyzing costs and profits may still arise because of perfunctory cooperation or outright obfuscation by the firm and because of the complexity of the accounting questions themselves.

However, the extent of the informational advantages enjoyed by private firms will vary in different situations, as will the knowledge and capabilities of government regulators. Indeed, a sophisticated regulatory agency may enjoy greater knowledge of costs and pricing than a relatively small or inexperienced firm. Ease in measuring outputs and monitoring quality is also crucial. Disputes over costs and price can still

arise even if quantities of goods produced can be specified in simple terms and their quality unambiguously monitored. But problems in devising and enforcing workable contractual and regulatory arrangements are likely to be far easier to solve under these conditions than under circumstances in which it is difficult to specify how much of a product is really being furnished and there is room for disagreement as to quality.

Close attention is also needed to the extent to which conditions change over time and unexpected contingencies arise. Even in a static world, bargaining difficulties may arise as one or both parties seek to wriggle out from burdensome commitments. But there is less occasion for bargaining difficulties in a world in which conditions remain the same than in a more dynamic setting. A private firm, for example, will not be able to use control over new investment as a means of extracting concessions from government regulators if demand is steady and expanded facilities are not needed. Under conditions in which demand is rising and expanded facilities are desperately needed, by contrast, a private firm's control over investment may be a powerful source of bargaining leverage.

Relatedly, the degree to which change occurs also has implications for the viability of long-term contracting and franchising arrangements. Under static conditions, it is at least theoretically possible to devise equitable long-term arrangements under which firms enjoy protection for their investments in fixed facilities and agree to provide service at a given price. Indeed, assuming that no enforcement problems arise, a single episode of contract or franchise competition could arguably suffice to protect public and consumer interests forever. In a world that is not static, however, both the enforceability and the relevance of original contract or franchise terms may become increasingly problematical as time passes and conditions change. If contract terms need to be repeatedly renegotiated to cope with change, chances for the sorts of bargaining difficulties described above to arise are also greatly multiplied.

To recapitulate, economic theory suggests many similarities in the public policy challenges presented by the development of waterworks, electric utility, and cable television. The concept of public goods suggests that market forces cannot be relied upon to ensure that private waterworks, electric utility, and cable television firms furnish services over networks that may be valuable to society as a whole but that are not im-

mediately profitable. Even for goods and services that are profitable, the concept of natural monopoly indicates that simply permitting private firms to build rival waterworks, electric utility, or cable television networks will not suffice to ensure either that real competition will occur or that such competition as does arise will efficiently and sustainably protect consumer interests. Transaction cost analysis tightens the screws further, suggesting that competition for contracts or franchises to furnish public or private consumer goods over waterworks, electric utility, and cable television networks will afford only a temporary respite from the dilemmas of natural monopoly. Regardless of the details of contracting or franchising arrangements, government agencies and private firms are likely to find themselves enmeshed in long-term relationships, in which private firms are likely to enjoy informational advantages but both parties may find themselves at risk of opportunistic behavior.

Economic theory and transaction cost analysis also point to factors that can affect the severity of these challenges and make for varied outcomes. Important variables include the extent to which network owners face inter-product competition or other forms of market discipline, the character and the perceived importance of the public goods furnished, and the ease or difficulty of measuring quantities and monitoring the quality of both public and private consumer goods. It is also worth paying close attention, transaction cost analysis suggests, to how different ownership and regulatory arrangements fare in the face of change and unexpected contingencies.

The limits as well as the strengths of these analytical tools also need to be appreciated. The history of public policy toward waterworks, electric utilities, and cable television cannot be entirely explained in terms of economics and transaction costs. A broader perspective is needed. Analysis of transaction costs, for example, can help us understand why government officials and managers of networks have often found themselves enmeshed in two-party bargaining relationships. In and of itself, however, such analysis cannot tell us why people chose to pursue a particular bargaining strategy in a particular case. Furthermore, as critics of economically derived forms of “public choice” analysis point out, people quite often do not see fit to pursue individual interests in the public realm as they would when buying and selling on the market.<sup>20</sup> It is not at all inconsistent, for example, for the same person both to bargain vig-

orously for the best possible price on a new car and to vote to raise taxes for the good of the country.

As shall be seen in the chapters that follow, people in American cities have at times sought to realize extremely ambitious social and political goals through development of different networked systems. With large-scale waterworks in place, for example, some nineteenth-century reformers believed that cities could be transformed from filthy to clean, unhealthy to healthy, and fire-prone to safe. At its most utopian, the vision encompassed not only gleaming cities but a society of temperate and morally as well as physically clean individuals. By the beginning of the twentieth century, electrification too, had become “inextricably bound up,” according to historian David Nye, “with ideas of social progress and the transformation of human nature.”<sup>21</sup> Electricity’s very mystery, its ability to be somehow conveyed over thin strands of wire, its flexibility and ability to be drawn upon for heat, light, and power for a myriad of labor-saving, useful, and amusing devices all inspired visions of a better world amid the smoke, grit, and congestion of real life in late-nineteenth-century and early-twentieth-century American cities.<sup>22</sup> In the case of communications systems, utopian hopes have been if anything even more extravagant. Among the new forms of electronic communication excitedly hailed by enthusiasts as instruments of human amity and harbingers of world peace, for example, was the telegraph during the 1840s and 1850s, broadcast radio during the 1920s, and broadcast television during the 1950s. More modestly, cable enthusiasts during the late 1960s and early 1970s viewed development of advanced systems as a means of enriching culture and enhancing democratic decision making while at the same time breaking “the hold on the nation’s television fare now exercised by a small commercial oligarchy.”<sup>23</sup>

Although such hopes and aspirations have obviously not been completely realized, their historical significance should not be underestimated. As noted previously, ideological, social, and political contexts all play important roles in shaping technological systems. Only by reference to such contexts can many aspects of how waterworks, electric utilities, and cable television systems have come to be developed in the United States be understood. Municipal governments in nineteenth-century American cities, for example, typically built water supply and distribution systems on a far grander scale than did their European

counterparts. Explaining this pattern requires examining both ideas concerning public health and morality and aspects of legal and institutional history. Similarly, many features of how cable television systems have come to be developed in the United States cannot be understood without reference to ideas concerning the role of the media in a democratic society and to features of communication law and regulation.

Moreover, the sort of monopoly associated with networked systems has a political as well as an economic dimension. A monopoly presents issues of power and accountability as well as pricing and market failure. Indeed, the very idea of leaving it to the discretion of a single entity to control availability of service in different locales as well as price and quality can be viewed as problematical in political as well as economic terms. Left unaccountable or in the wrong hands, such sole discretion can present risks to society arising not only from the unchecked pursuit of profit on the part of a rational monopolist but of a whole range of costs or harms arising from incompetent, arbitrary, or even capricious decision making. Allegations that overly concentrated power in the hands of those who control networked systems has resulted in the corruption or vitiation of democratic accountability have been common criticisms of many different ownership and regulatory arrangements in waterworks, electric utilities, and cable television alike. Aversion to monopoly has also had profound effects on the institutional settings in which decision making concerning these systems has taken place. Indeed, distrust of unchecked power of any sort is woven into the very warp and woof of the American polity.

Even before the American Revolution, many politically conscious people in the Thirteen Colonies were greatly influenced by the ideals of the English Commonwealthmen or “True Whigs.” The Commonwealthmen emphasized the dangers of unchecked executive power both to individual freedom and to trade and the generation of wealth. They believed, in the words of historian Bernard Bailyn, that “if the vigilance of the people was ever thoroughly softened by negligence, sloth or corruption, the ever-watchful monopolists of power would soon act.”<sup>24</sup> After the Revolution, denial by the Articles of Confederation of independent authority on the part of the national government to enforce its resolutions or levy taxes represented a continued manifestation of this fear of concentrated and centralized power. Although the Constitutional Con-



vention assembled in 1787 put in place a framework for a far stronger national government than would have been possible to create under the Articles of Confederation, states continued to retain a high degree of autonomy and the authority of the central government was divided among the three branches.

To say the least, much has changed in the United States over the course of the last two hundred years. Amid the cataclysm of civil war during the 1860s, slavery was abolished and the principle that states could not secede from the Union established. During the years since the Civil War, the relative importance of the federal government has greatly increased and the size and administrative capabilities of government at all levels have grown. Nevertheless, complex divisions of governmental authority and decision making remain that have no real counterpart in France, Great Britain, or the other relatively unitary states of western Europe.

As shall be seen, these divisions of governmental authority have often worked to the advantage of private network owners in the United States. In many instances, firms have been able to gain relief from unfavorable actions by one level of government by appealing to another or by turning to the courts.<sup>25</sup> Competition among a multitude of local and state jurisdictions for the fruits of economic growth has also tended to spur local and state governments to implement policies designed to encourage or even subsidize the construction of networked systems and infrastructure while reducing their willingness and ability to impose restrictions on the private firms involved.<sup>26</sup> Nevertheless, private network owners have not always had things their own way. Allegations of abuses of power, beliefs that public ends were being inadequately served by private firms, and concerns with economic development have at times combined to inspire stringent regulatory initiatives and even turns to outright government ownership.

I bring these themes together in the chapters that follow.<sup>27</sup> I discuss political and institutional contexts in which the development of waterworks, electric utilities, and cable television systems took place in the United States. I also compare the character of public and private consumer goods demanded in different settings, problems and controversies that arose in arranging for provision of these goods, roles played by economic and transaction cost issues in engendering these problems, and

how different factors ultimately came together to shape the choice of ownership and regulatory arrangements. For each network I both survey broad trends and present detailed historical case studies of events in individual cities. The case studies afford examples of more or less typical outcomes with respect to technology, ownership, and regulation as well as examples of outcomes that diverged from the norm in revealing ways.

In chapter 2, I turn my attention to urban water supply and distribution systems during the nineteenth and early twentieth centuries. As shall be seen, these systems came to be increasingly relied upon to serve a range of pressing consumer and public demands as major American cities swelled in size. Unfortunately, municipal governments faced severe difficulties in arranging to have private waterworks firms serve the demands. I describe the kinds of problems that arose and explore the roles played by lack of market discipline, informational issues, change, and contingencies in causing the difficulties. I also consider how people understood and responded to waterworks issues and why municipal ownership movements more frequently triumphed in rapidly growing cities than in their more stable counterparts.

I then look at the issues through detailed accounts of events in three very different cities—Boston, San Francisco, and Seattle. As shall be seen, attributes of technology made for similarities in public policy issues presented by the waterworks in all three cities. The commonalities stand out in particularly sharp relief because of the very distinctiveness of the historical and geographic contexts in which waterworks development and decision making took place. During the first years of the twentieth century, for example, San Francisco experienced some of the same kinds of difficulties in obtaining public services from its private waterworks firm as did Boston during the 1820s and 1830s. However, experiences in the three cities were not entirely homogeneous. For example, private waterworks ownership persisted far longer in San Francisco than in either Boston or Seattle. San Francisco's private waterworks firm also invested in far more elaborate supply and distribution facilities than did its counterparts in most other American cities. To place the roles played by technological and economic factors in broader context, I conclude the chapter with a brief comparison of experiences in American and western European cities. I explore some of the subtle yet powerful ways in

which characteristics of political and institutional arrangements have shaped waterworks technology itself in different locales.

In chapter 3, I extend the analysis to electric utilities. The primary focus is on the development, ownership, and regulation of electric utilities in major American cities during the formative decades of that industry's development: from the 1880s through the 1920s. I compare the kinds of issues that arose in arranging for provision of public services and consumer goods by private electric utility and waterworks firms and consider the roles played by economic and transaction cost factors in determining why problems occurred in some settings but not in others. I also consider ways in which outcomes in both electric utilities and waterworks have been affected by aspirations for economic growth on the part of urban political leaders, suspicions of undue concentrations of economic and political power in the hands of either governmental or private entities, and the divisions of governmental authority built into American federalism.

As in waterworks, I both survey broad trends and present detailed accounts of events in Boston, San Francisco, and Seattle. In these and many other American cities during the late nineteenth and early twentieth centuries, complaints of monopolistic abuses and corrupt practices by private electric utility firms arose and large numbers of people called for municipal governments to build or acquire their own systems. In both Boston and San Francisco, however, campaigns for municipal electric utility ownership foundered. Instead, state governments asserted jurisdiction over private electric utility firms and restricted roles played by municipal authorities in either providing or regulating services. Municipal ownership campaigns fared similarly in most other major cities in the United States. In a significant minority of cases, however, advocates of municipal ownership realized their goals. During the first decades of the twentieth century, Seattle's municipal government developed and extended its own electric utility network throughout the city. Events in Seattle were also unusual in another respect. Despite the natural monopoly attributes of electric utility distributions systems, private and government-owned electric utilities directly competed with one another in many areas of the city for decades. I use analysis of this unusual case to gain insight into factors driving more typical outcomes in both waterworks and electric utilities.

In chapter 4 I turn to cable television and the communications and media complex of which it forms a part. As noted, cable television systems resemble waterworks and electric utilities in that they have been developed (at least thus far) primarily as instruments for the one-way delivery of services. But there are also major differences. Cable television systems are not really vital infrastructures in quite the same sense as are waterworks and electric utilities. Even a long-term disruption of cable television service in a major American city would be only a nuisance—not a disaster. At the same time, however, provision and control of media content is of central importance to social and political life in a way that is not true of either water or electricity. For this reason, concerns over undue concentration of political power have loomed even larger in cable television than in either of the other two networks.

I place these concerns in historical context with a broad overview of major themes and tensions in the politics of communications in the United States over the last two hundred years. I then discuss public policy issues that have arisen in association with the development of broadcasting and cable television during the twentieth century, exploring ways in which these issues have been influenced by basic attributes of broadcasting and cable television technology. I also consider the roles played by public policy in shaping how broadcasting and cable television systems were actually built and operated in the United States.

As compared to either waterworks or electric utilities during their formative years, a larger share of the policy making “action” in broadcasting and cable television has taken place at the federal level. Judicial decision making also has consistently been important. For this reason, the discussions of broadcasting and cable television largely focus on developments in these domains. In the case of cable television, however, municipal governments have also been significant actors. Particularly during the 1970s and 1980s, a number of cities in the United States engaged in elaborate exercises in which they arranged for private cable television firms to compete for the right to furnish service in a given locale based upon price and service terms offered. In examining developments in particular cities, my primary emphasis is on the achievements and vicissitudes of such franchise contracting.

I present detailed accounts of events in Pittsburgh, Boston, and Seattle. Pittsburgh and Boston represent exemplars of cities that en-

gaged in relatively well-structured bidding contests for such cable television franchises. Seattle is of interest, by contrast, because of the diversity of regulatory approaches employed and the relatively limited role played by franchise bidding. In a rough kind of way, Seattle affords a kind of baseline against which the strengths and weaknesses of more elaborate bidding approaches can be discerned more clearly. As shall be seen, some of the same factors affected the functioning of regulatory and franchising arrangements in cable television as in waterworks and electric utility systems more than one hundred years before.

I conclude the book with a discussion of contemporary issues presented by networked systems in historical context. The emphasis is not on prediction (an enterprise fraught with risk of embarrassment to the author) but on delineating ways in which sense can be made of contemporary and future happenings in light of historical patterns of change and continuity.