

Introduction

There is much which we must leave, whether we like it or not, to the un-“scientific” narrative method of the professional historian.

—Norbert Wiener, *Cybernetics, or Control and Communication in the Animal and the Machine*, 1948, concluding line

The Soviet Union was home to hidden networks. The story told here about those networks hangs on a hook that is unfamiliar to most readers and scholars—the Soviet Internet. At first glance, pairing the Internet and the Soviet Union appears paradoxical. The Internet first developed in America and became popular only after the Soviet Union collapsed. The Internet suggests to general readers open networks, flat structures, and collaborative cultures, and the Soviet Union signals censored networks, hierarchies, and command and control cultures. What, then, could the phrase *Soviet Internet* possibly mean?

The central premise of this book holds that there was once something that we might think of as the Soviet Internet. Between the late 1950s and the late 1980s, a small group of leading Soviet scientists and administrators tried to develop a nationwide computer network that was designed for citizen communication and sweeping social benefits. This book is about their story. At the height of the cold war technology race, the Soviet Union was awash in intelligence about contemporary Western initiatives, including the Semi-Automatic Ground Environment (SAGE) project at the U.S. Department of Defense. The Soviet state had all the necessary motives, mathematics, and means to develop nationwide computer networks for the benefit of its people and society. This book also ventures analysis on why, despite pioneering national network projects from the most promising of scientists and administrators, the Soviet state proved unable and unwilling to network its nation.

This much is clear: the Soviet Union never had the Internet as it is known today.¹ Rather, in the early 1960s, Soviet cyberneticists designed the most prominent of the network projects examined here—the All-State Automated System (OGAS)—with the mission of saving the entire command economy by a computer network. Their elaborate technocratic ambition was to network, store, transmit, optimize, and manage the information flows that constituted the command economy, under the guidance of the Politburo and in collaboration with everyday enterprise workers, managers, and planners nationwide.

The historic failure of that network was neither natural nor inevitable. Its story is one of the lifework and struggles of often genius cybernetic scientists and administrators and the institutional settings that were tasked with this enormous project. The question deserves a sympathetic and rigorous examination of the Soviet side of the story. Why did Soviet networks like the OGAS not take root? What obstacles did network entrepreneurs face? Given unprecedented Soviet investments and successes in mathematics, science, and some technology (such as nuclear power and rocketry), why did the Soviet Union not successfully develop computer networks that were capable of benefiting a range of civilian, economic, political, social, and other human wants and needs? How might we begin to rethink our current network world in light of the Soviet experience?

I propose that the primary reason that the Soviets struggled to network their nation rests on the institutional conditions supporting the scientific knowledge base and the command economy. Those conditions, once examined, challenge conventional assumptions about the institutions that build open, flat, and collaborative networks and thereby help recolor the cold war origins of the information society. It is a mistake, as the standard interpretation among technologists and some scholars have it, to project cold war biases onto this history. Our networked present is the result of neither free-market triumphs nor socialist state failures.

That said, let us begin with a slight twist on the conventional cold war showdown: the central proposition that this book develops and then complicates is that although the American ARPANET initially took shape thanks to well-managed state subsidies and collaborative research environments, the comparable Soviet network projects stumbled due to widespread unregulated competition among self-interested institutions, bureaucrats, and other key actors. The first global civilian computer networks developed among cooperative capitalists, not among competitive socialists. The capitalists behaved like socialists while the socialists behaved like capitalists.

In the process of examining and elaborating on that plain statement about the cold war history of networks, this book describes two intersecting

approaches to larger questions of social control and change—one institutional and the other technological. The first approach looks at the context of Soviet institutions and political bodies that were preoccupied with both the paperwork and the power brokerage behind the socialist command economy. The question of how to organize economies, especially but not only the Soviet command economy, is shown to be political before it is economic. The second approach accounts for the attempts of Soviet cyberneticists to build a computer system over a period of about thirty years from 1959 to 1989 that would control in real time the economy's problems. The two approaches—political economy and computing technology—combine and play out here on the common stage of Soviet cybernetics, a midcentury discipline that was interested in systematizing all organization problems with computing technology. The result is a tragic story that addresses questions that are central to the history of technology and global media theory: what makes the same technology take shape differently in different contexts?

To explore that tragedy, the book sets up the dramatic potential of a networked command economy, the loss of that potential in the hands of the state, and a critical reclamation for contemplation, reflection, and contemporary instruction. The limitations of this work's scope are also clear. Although it focuses primarily on the cybernetics and economic concerns besetting Viktor Glushkov and his Kiev-based OGAS team between 1959 and 1989, the setting is broader, including the military, industrial, and academic complexes that stretched from the seat of power Moscow to other cities, including St. Petersburg to the north and Akademgorodok (a science city that was nestled deep in Siberia) three thousand kilometers to the east.² The book also seeks to comment on the Soviet Union as a perceived state of exception on the global geopolitical stage. As one pole in the global cold war, the Soviet state stood unrivaled among socialist states in terms of international military and political influence.³ In their search for a balance of focus and breadth, historians of science and technology have called for midpicture history, or a case study drilled deeply to explore intersecting historical subdisciplines (not entirely unlike Robert Merton's middle-range theory). This book is not a midpicture history, although I hope its best moments may model how media history and theory can move in tandem with information science and technology. In its most ambitious moments, this book offers a synthesizing commentary (in the premodern sense of the central genre of scholarship, not derivative status) about the sources of the modern network age.⁴

This book seeks to complicate the popular memory of the Soviet Union—its heady promises of socioeconomic justice as well as its parade of horrors,

including authoritarian abuses, violence, and a cumbersome state hierarchy that subjected its citizens to political oppression and information censorship. It examines the Soviet command economy, which proved inflexible to the fluctuating demands of the emerging global network economy and eventually imploded on itself. Some readers may feel that the Internet and the Soviet Union seem to be fundamentally opposed information projects: one is a salvific vehicle for the invisible hand of modern-day commerce, and the other is remembered for its dead hand; one led to the knowledge explosion that is *Wikipedia*, and the other, to the nuclear catastrophe at Chernobyl; one produced Linux, and the other, the Lada; one is a haven for technoenthusiasts, libertarians, and free-speech absolutists, and the other, the whipping boy for the same. But I seek to bring to English-language readers the story of the Soviet computer network in its own terms. Given that the story is not singular, my emphasis is on relating the untold story of the All-State Automated System project and its research network led by the mathematician Viktor Glushkov in Kiev (the current capital of Ukraine) between 1959 and 1989. The case study arrives couched in commentary that seeks to upend and move beyond residual binary narratives about the cold war origins of the current networked age.⁵

The internal historical setting for the tragic tale begins with the turbulent grab for power that followed the death of Joseph Stalin in 1953 and stretches through the halting internal unraveling of that power in the 1980s. There was an unusual contender for filling the political vacuum left by Stalin's passing. To the scientists under study here, Stalin's best replacement was no person at all but rather a technocratic conviction that computer-aided governance could avoid the past abuses of its strongman state. The All-State Automated System was a utopian vision of a distinctly state socialist information society as well as, closer to home, a familiar story of how bright men and women struggle to employ both might and machines in the service of social justice and greater public goods.⁶

A thin line sometimes separates tragedy from comedy. Backlit by reflections on cold war political economic orders, the fickle muses of historical contingency staff this drama. For example, family preferences for warmer weather ended up shifting the centers of scientific development, empty chairs at crucial meetings sank decade-long campaigns, informal whims of power shipwrecked careers and perhaps countries, basic notational systems (not sophisticated algorithms) revolutionized long-term strategic thinking (and Soviet chess), and countless other details rained down via informal bureaucratic actions on the Soviet knowledge base. All these and others blur the comic and tragic elements. The Soviets could have developed a

network contemporary to the ARPANET, and yet they did not. What makes this story tragic is not that the Soviet political, economic, and technological networks collapsed but that the deeper problems that beset the USSR have been transformed but have not disappeared. The twenty-five years following the collapse of the Soviet Union have reaffirmed that Russia, although no longer in a superpower showdown with the West, remains anything but a negligible actor on the global stage and that the patterns of its state governance are much older than the post-Soviet transition. By triangulating across the central Soviet-American cold war axis to emphasize Ukrainian and other liminal people and places, this book aims to help readers rethink residual cold war misunderstandings in popular network and digital media discourse while simultaneously showcasing the institutional tensions at the heart of modern-day networked practices, policies, and politics.

The curtain parts on two anecdotes about Soviet networks. The first introduces the central story, and the second marks the limit of that story. In late September 1970, a year after the ARPANET went online, the Soviet cyberneticist Viktor Glushkov boarded a train from Kiev to Moscow to attend what proved to be a fateful meeting for the future of what we might call the *Soviet Internet*. On the windy morning of October 1, 1970, he met with members of the Politburo, the governing body of the Soviet state, around the long rectangular table on a red carpet in Stalin's former office in the Kremlin. The Politburo convened that day to hear Glushkov's proposal and decide whether to build a massive nationwide computer network for citizen use—or what Glushkov called the All-State Automated System (OGAS, *obshche-gosudarstvennyi avtomatizirovannaya system*), the most ambitious computer network project of its kind in the world at the time. OGAS was to connect tens of thousands of computer centers and to manage and optimize in real time the communications between hundreds of thousands of workers, factory managers, and regional and national administrators. The purpose of the OGAS Project was simple to state and grandiose to imagine: Glushkov sought to network and automatically manage the nation's struggling command economy.

What transpired in Stalin's former office that day enters into the story. Throughout this (and perhaps all) history, the messy details often matter most. In this case, two crucial chairs in that committee room were empty on that particular day due to the contingencies of the calendar and competitive bids for power. This book's analysis will note how pesky details often reveal hidden patterns of institutional (mis)behavior that structure and reshape the interests of public actors, organizations, and even economic

and social relations. Taken together, the history and analysis of the OGAS and related attempts to network and command the Soviet economy tell a story with consequences for the history of cold war computer networks and our understanding of the current networked world that emerged from the cold war itself.

The second anecdote took place not far from Glushkov's fateful meeting in the Kremlin. Here, in a top-secret chamber in a cement bunker, or *shariki* ("spheres" or "globes"), buried deep underground somewhere outside of Moscow, was a very different kind of computer network. In that small room, a few uniformed personnel sat before flickering computer screens that were powered by an independent generator purring audibly nearby but out of sight. The single closed door was of reinforced metal with a self-locking mechanism, and behind it a long ladder ascended into a network of underground tunnels overhead. The chairs were bolted to the floor and pivoted to allow the military officers to review a control panel lined with information displays—satellite data and security camera feeds, telephone and radio signals, Geiger counters and seismographs, and other instruments for measuring the world above. These men sat at their consoles, operating as cogs in a larger sociotechnical machine. They were trained so that if or when the time arrived, they would observe the sensors, orient and input certain coordinates and a timetable, flip switches, and press a button that would end the world in a nuclear Armageddon.

This is Dead Hand, the semiautomatic nuclear-defense perimeter system that was first installed in the late Soviet Union. The details above are mostly pure invention, and yet the network system is real. Formally called Systema "Perimetr," the perimeter system was imagined under Brezhnev as a fail-deadly deterrence mechanism for ensuring second-strike capacity in the nuclear cold war.⁷ These men—not unlike the U.S. workers who staffed the Emergency Rocket Communication System from 1961 to 1991—sat in the top-secret underground command-and-control center of their nation's perimeter system. The data were fed into computer consuls to confirm whether the enemy had struck first. If an American military strike effectively disabled the regular Soviet command-and-control military leadership above ground from swiftly retaliating, then the strategy maintained that the Dead Hand would stand ready to trigger "a spasm of destruction."⁸ After the national computer network system was activated, it would put on alert nuclear-tipped intercontinental missiles that were stored thousands of miles away. The red button, once pressed, would launch a massive retaliatory nuclear strike, enacting swift revenge at a global cataclysmic scale. Behold the apocalypse—delivered by national network.

This book is about civilian networks, not military networks. This is a deliberate choice. I choose to emphasize public networks because a network built for every Soviet worker still speaks to the popular and scholarly imagination of our current socially networked world in ways that closed military networks do not, although, as we will see, the military's relationship to technological innovation backlights the whole stage of cold war science.

A sideways look at some of the discourse about online commerce today proposes the enduring relevance of the Soviet socialist revolution that was consummated a century ago. Both the Internet and the Soviet command economy promise the revolutionary realization of the means for socialist or collectivist production on a mass scale. In the rhetoric of networking collective consciousness and crowd-sourced collaboration, we see the unlikely alliance of *Wired* editor Kevin Kelly's hive mind, open-source software promoter Eric Raymond's bazaar, and Marxist revolutionary Leon Trotsky's collective farm.⁹ Long before Internet enthusiasts were around, Soviet enthusiasts were promising that workers (users) could meet the needs of the masses (crowds) through collective modes of resource sharing and collaboration (peer-to-peer production).

Few, if any, contemporary scholars recognize these concerns as fundamental to our modern network culture, and yet they persist in coloring views of both past and future. This is no accident: the concurrent emergence of cyberspace and post-Soviet affairs entered scholarly and popular discourse at the tail end of the previous century. For example, sociologist Manuel Castells has developed an extensive argument detailing how the Soviet Union failed to enter the information age, which this book is in some ways a sideways response to, and legal scholar Lawrence Lessig used his experience observing the rapid deregulation and privatization in post-Soviet economic transition in the early 1990s as a formative analog for what he felt was an equally disastrous attitude about the supposed unregulability of cyberspace common in the late 1990s.¹⁰ Since then, scholars have recognized that the summary experiences of perhaps the last two great information frontiers of the twentieth-century—the rise of post-Soviet economic transition and the Internet—present not, as Francis Fukuyama infamously claimed, the end of history so much as a new chapter in it. Leading cyber legal scholar Yochai Benkler has argued for a middle way by observing how online modes of “commons-based peer production” sustain capitalist profit margins through collectivist forms of reputational altruistic communities that do not depend on individual self-interest.¹¹ From the final chapters of Soviet history, we may begin to observe and puzzle through the perennial fact that, for many Western technologists and scholars, the promise of

socialist collaboration shines brightest online today—a promise that the Soviet OGAS designers were among the first to foresee.

None of the conditions—technological, sociological, economic, or otherwise—for the flourishing of computer networks are necessarily as we may think. As Melvin Kranzberg's first law of technology holds, technology is neither positive, negative, nor neutral.¹² The same holds for society and economy. By looking at failed network projects, I seek to flip science anthropologist and philosopher Bruno Latour's aphorism that technology is society made durable. We observe in the collapse of the Soviet network projects a lesson for humans who live in a fragile world: society too is technology made temporary.¹³ The Soviet experience with networks reminds us that although computer networks are prospering today, our modern social assumptions about those networks are no more inevitable or permanent than those of the Soviets. Our current beliefs about networks will pass. This book looks to take in a new direction what science and technology scholars Geoffrey C. Bowker and Leigh Starr have called an "infrastructural inversion": looking closely at the alternative setting of a Soviet networked society can shake up a modern mental infrastructure that makes the current networked environment appear natural and necessary.¹⁴ Sometimes the best way to see something is to look away from it. The French revolution, as historian Eric Hobsbawm has noted, did not become *the* French revolution until it was seen in the context of the British industrial revolution and the revolutions of 1848.¹⁵ We stand to apprehend the current network transformations better by placing the past in the context of a wider world. By exploring the pathway that was once taken and then abandoned in cold war networks, I hope to help unsettle, broaden, and deepen our imagination for the possibilities that gave rise to the modern networked media environment.

The literature on which this book builds is growing. Above all, this book builds on the historical foundation that was laid by the pioneering works of historians of Soviet science, Slava Gerovitch and Loren Graham.¹⁶ Slava Gerovitch's article "InterNyet: Why the Soviet Union Did Not Build a Nationwide Computer Network," which he shared with me in draft form while I was independently pursuing the Soviet Internet story in archives in Moscow, jumpstarted this history with a treasure chest of scholarly leads. His work has opened many windows into the Soviet history of science and its associated social problems. The literature in English on the midcentury development of computer networks—by leading scholars such as Janet Abbate, Finn Burton, Paul N. Edwards, Fred Turner, and Thomas Streeter—also includes works that examine the creative communities, institutional

innovation and setbacks, cold war tensions, and Western internal politics that backlight this particular case study.¹⁷ This work attempts to help internationalize the core insights of this sociologically sensitive body of analysis into the people and places that shape networks.

The literature also teaches that the significance of the global spread of a social network often precedes, exceeds, and coevolves with that of any specific technological network. To borrow a line from Elihu Katz, international communication networks precede national computer networks.¹⁸ Along these lines, historian of technology Eden Medina's *Cybernetic Revolutionaries: Technology and Politics in Allende's Chile* advances a seminal history and analysis of early technological and political attempts to network another socialist state during the cold war. Her close and careful analysis of the people involved in the creation of Project Cybersyn (especially 1971 to 1973) reveals how the significance of technological projects carries beyond and exceeds that of specific network projects.¹⁹ Her work, together with other recent scholarship on international cybernetic movements, helps outline the central cast of characters in this book.²⁰ This cast was not selected exclusively from cybernetic scientists or administrators. Rather, the characters are drawn from what I call the "knowledge base" of the Soviet Union—theoretical and applied scientists, their laboratories and research centers, students in universities, administrators in the academies of science, state office bureaucrats, generals in the Ministry of Defense, ideologues and censors in the scholarly and public press, the secret police, functionaries, officials, midlevel managers, members of the Central Committee of the Communist Party, and others whose careers depended on the management, manipulation, and representation of knowledge as an intellectual, institutional, and innovative product.²¹

Finally, a practical note about language. All translations from Russian and Ukrainian into English are my own unless otherwise noted. In translating, as Stephen Jay Gould says, "we reveal ourselves in the metaphors we choose for depicting the cosmos in miniature."²² This is true of the translation process as a way of trying to bring separate languages into resonance. Sometimes words can be translated straightforwardly. For example, this work, an interdisciplinary exercise in the emerging field of network studies, seeks to articulate a fluid discourse around the central term *network*. The term *network*, like other keywords in digital discourse, packs more meaning than is usually seen and has roots in the textile industry of lacework, like the Jacquard loom behind computer programming techniques (there may be more silk than silicon to the information age). The Russian term *set'* maps fairly well onto my three English uses of the term *network*—(1) a

technical communication network understood as interlinked digital, electronic, telephonic, or other channels of communication; (2) the complex sociotechnical assemblage of heterogeneous relations that link people, institutions, and the administration of markets, states, and other actors in everyday life; and (3) an abstract organizational mode that maps the linkages between any set of objects, such as graph theory in mathematics.²³ Although all of these meanings are in play here, what we assume to be a relatively settled term today behind the concept of *network* (*set'*) took up in Soviet discussions an even wider set of terms such as *base*, *complex*, *cluster*, and most characteristically for computers connected over distances, *system*.

At other times, Russian terms reveal their own world in how they resist easy translation. I occasionally retain, for example, the early Soviet term for *computer*, “the automatic high-speed electronic calculating machine” (*avtomaticheskaya byistrodeistvuyushchaya elektronicheskaya schyotnaya mashina* and its various shortenings) for its splendidly descriptive bulk that signals perhaps the most elegant definition of new media I know: new media are those media we do not yet know how to talk about.²⁴ The probability theorist Aleksandr Ya. Khinchin revealingly renders what is known in English as “queuing theory” (used by information theorists to describe how data packets wait in line) as “mass-service theory” (*teoria massovogo obsluzhivaniya*) in Russian.²⁵ Sustaining the anthropological gaze requires depicting the variable sets of cultural, social, and political values in comparative relief with the network elements that are all too familiar in modern culture, which I have attempted to do here whenever relevant.

I have also tried to write with the conviction that plain language packs in its own insights. By proposing for further examination that the first global civilian networks took shape thanks to capitalists behaving like socialists, not socialists behaving like capitalists, I understand the terms *capitalism* and *socialism* in the ordinary way. I define *capitalism* as the order of the market economy, where economic actors act independent of the state, private property rights are reasonably secure and dominate most enterprises, prices and trade are predominantly free, state subsidies are limited, and transactions mostly monetized. *Socialism*, by contrast, is an economic order of the command economy where the opposite can usually be expected, although with its instinct to communism operating according to the moral and political principle “from each according to their abilities, to each according to their needs.”²⁶ The argument here depends not on collapsing that definitional divide but on revealing how that ordinary understanding falls short of describing mixed constellations of competitive and collaborative practices—public-private and state-market formations that belie and

tweak our sense of these opposing economic orders. Evidence complicates the tidiness of ideas. This is a conventional *a priori* to foundational work in general scholarship and in institutional economics, which look to the complexities of behavior and scale them toward understanding the unpredictable behaviors of modern state and market relations.²⁷

At other times, new phrases have been introduced to familiarize readers with a foreign context. I have attempted to cast a critical eye on all source materials, and the careful act of weighting and arranging evidence has pressed on my work its own brand of insight and argument. For example, after observing the extraordinary lengths to which Soviet scientists went to promote economic reform with networks, I settled on the phrase *network entrepreneur* to cast a new light on the dynamics of the knowledge base in Soviet science and technological innovation. This word choice might seem misplaced because the Soviet knowledge base appears at first glance to carry none of the cultural or conceptual weight of venture capital, investment risk, and inherited responsibility for an enterprise that typically is associated with the modern English term *entrepreneur*. And yet the Soviet Internet makes a fitting case study in the global history of technology entrepreneurs, from Thomas Edison to Steve Jobs to Sergei Brin. That history has yet to be written, although when it is, it will feature an international species of actors, among them Soviets, who were prone to repeat bold slogans before proceeding by bolder failures.²⁸ Those who are uncomfortable applying a capitalistic term to comparable socialist practices may do well to recall that the English *entrepreneur* is already on loan from the French.

Structure

This book proceeds in five roughly chronological chapters. Chapter 1 introduces the global consolidation and spread of cybernetics as a midcentury science in search of self-governing systems from World War II to the mid-1960s. It also notes that cybernetics articulated internationally distinct scientific dialects to try to harness a range of different information systems—including biological, mechanical, and social—under one umbrella science. The term *heterarchy* is introduced as a cybernetic term for complex networks with multiple conflicting regimes of evaluation in operation at the same time. Also looked at are the mind and its neural networks (including the brain and the nervous system) as an international analogy of choice for thinking about national networks. Then the chapter examines the historical backdrop of the sequential rejection, adoption, adaptation, and mainstreaming of cybernetics in the 1950s and 1960s Soviet Union,

against which the central tragedy of the remaining chapters and cast of characters unfolds.

Chapter 2 examines the emergence of economic cybernetics in the late 1950s and early 1960s as a field that was closely allied to mathematical economics and econometrics yet peculiar in its implications in the international sphere of Soviet intellectual and political influence. It also outlines and describes the basics behind the command economy and the tremendous coordination problems that the Soviet state and competing schools of orthodox, liberal, and cybernetic economists all agreed needed to be addressed and reformed in the early 1960s. A few sources of the organizational dissonance, including heterarchical networks of institutional interests, that was underlying the Soviet command economy and its state administration are also introduced.

Chapter 3 chronicles the first three aborted attempts to network the Soviet nation. The first was Anatoly Kitov's pioneering proposal in the fall of 1959 to build a nationwide computer network for civilians on preexisting military networks. The resulting show trial removed him, the first Soviet cyberneticist and a star military researcher, from the military. The second attempt was the short-lived technocratic proposal by Aleksandr Kharkevich in 1962 to build a unified communication system for standardizing and consolidating all communication signals in the Soviet Union. And the third attempt was the simultaneous proposal by N. I. Kovalev for a rational system for economic control using a nationwide web of computer networks. Brief attention is paid to the historical concurrence of cold war networks, including a caution against the cold war preoccupation to overvalue claims to being historically "first" in and outside of Soviet science.

Chapter 4 introduces the most ambitious and prominent of Soviet network projects—the All-State Automated System (OGAS)—and its primary promoter and protagonists, the cyberneticist Viktor M. Glushkov, whose stories are brought together for the first time in English. This chapter details what is known about the sweeping theoretical and practical reach of the OGAS Project between 1962 and 1969, its vision for an economy managed by network, and the institutional landscape that evolved in support of that initial project proposal in the 1960s. It also presents snapshots of both the playful work (counter)culture and informal institutional obstacles that began to preoccupy two of the most prominent research institutes for economic cyberneticists—Nikolai Fedorenko's Central Economic-Mathematical Institute (CEMI) and Viktor Glushkov's Institute of Cybernetics—in the same decade.

Chapter 5 chronicles the slow undoing of the OGAS between 1970 and 1989. Neither formally approved nor fully rejected, the OGAS Project found itself (and proposals to use computer-programmed networks to plan social and economic resources, including those by the chess grandmaster Mikhail Botvinnik) stalemated in a morass of bureaucratic barriers, mutinous ministries, and institutional infighting among a state that imagined itself as centralized but under civilian administration proved to be anything but. By the time that Mikhail Gorbachev came to power, Glushkov had died, and the political feasibility of technocratic economic reform had passed. This chapter frames how hidden social networks unraveled computer networks.

The conclusion reflects on and complicates the plain statement that is the conceit of this book—that the first global computer networks began among cooperative capitalists, not competing socialists. Borrowing from the language of Hannah Arendt, it recasts the Soviet network experience in light of other national network projects in the latter half of the twentieth century, suggesting the ways that the Soviet experience may appear uncomfortably close to our modern network situation. A few other summary observations for scholar and general-interest reader are offered in close.