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Daniel F. Spulber and Christopher S. Yoo

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## NETWORKS IN TELECOMMUNICATIONS

### *Economics and Law*

*Networks in Telecommunications* addresses fundamental issues in discussions of regulatory policy by offering an integrated framework for understanding the economics and law of networks. It extends theories on network design associated with the mathematics of graph theory, which provides insights into the complex, systemic interrelationships among network components. It also applies the principles of transaction cost economics to analyze decisions about the appropriate boundaries of proprietary network architecture. The book introduces network theory into the study of the economics and law of telecommunications. The discussion opens up the black box of the cost function in telecommunications. The analysis also goes beyond the “network externalities” approach, which focuses primarily on the size of networks. The book highlights the effects of network architecture and the tradeoffs inherent in network design.

Daniel F. Spulber is the Elinor Hobbs Distinguished Professor of International Business and Professor of Management Strategy at the Kellogg School of Management, where he has taught since 1990. He is also Professor of Law at the Northwestern University School of Law (Courtesy) and founder of Kellogg’s International Business and Markets Program. Founding editor of the *Journal of Economics and Management Strategy*, Professor Spulber has received eight National Science Foundation grants, three Searle Fund grants, and two Ewing Marion Kauffman Foundation grants for economic research. His current research is in the area of international economics, industrial organization, management strategy, and law. He is the author of 11 other books, including *The Theory of the Firm: Microeconomics with Endogenous Entrepreneurs, Firms, Markets, and Organizations* (2009), *Global Competitive Strategy* (2007), *Market Microstructure: Intermediaries and the Theory of the Firm* (1999), and *Deregulatory Takings and the Regulatory Contract: The Competitive Transformation of Network Industries in the United States* (with J. Gregory Sidak, 1997), all from Cambridge University Press, and *Management Strategy* (2004), *The Market Makers* (1998), and *Regulation and Markets* (1989).

Christopher S. Yoo is Professor of Law and Founding Director of the Center for Technology, Innovation, and Competition at the University of Pennsylvania Law School. He is also Professor of Communication at the Annenberg School for Communication at the University of Pennsylvania (Courtesy). Formerly Professor of Law at Vanderbilt University, he was also Founding Director there of the Technology and Entertainment Law Program. Professor Yoo earlier clerked for Justice Anthony M. Kennedy of the Supreme Court of the United States and Judge A. Raymond Randolph of the U.S. Court of Appeals for the D.C. Circuit. He coauthored *The Unitary Executive: Presidential Power from Washington to Bush* (with Steven G. Calabresi, 2008) and has written more than three dozen book chapters and articles in the *Columbia*, *New York University*, *University of Pennsylvania*, *Cornell*, and *Northwestern University* law reviews, as well as the *Harvard Journal of Law and Technology* and the *Yale Journal of Regulation*, among others. Professor Yoo’s research focuses primarily on how technological innovation and economic theories of imperfect competition are transforming the regulation of the Internet, representing a leading voice in the debate over network neutrality.

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# Networks in Telecommunications

Economics and Law

**Daniel F. Spulber**

Northwestern University

**Christopher S. Yoo**

University of Pennsylvania



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*We dedicate this book to our wives, Sue and Kris, for their patience,  
understanding, and encouragement throughout this long project*

*D.F.S. and C.S.Y.*

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## Preface

Networks in communications, transportation, and distribution are fundamental features of the modern economy. Network industries are a major source of economic growth and a key component of economic development. The expansion of telecommunications, the Internet, and mobile communications has accompanied innovations in information technology. Although electronic commerce was once viewed as a specific category of business transactions, practically all business activity has come to depend on digital communications networks.

Public policymakers are keenly aware of the critical role of telecommunications in the economy. A great shift in regulatory focus has occurred, from more traditional utility regulation to access mandates. Examining changes in public policy in telecommunications requires a more fundamental understanding of the structure and function of networks. Expansion of the economics and law literatures on networks has accompanied economic and technological developments. The purpose of this book is to evaluate the implications of this public policy shift and to achieve a better understanding of public policy toward networks.

To achieve these objectives, the book develops a comprehensive framework for the study of telecommunications networks. We draw upon important developments in the graph theory that is used to represent networks. We examine economic models of networks and apply these developments to study the legal aspects of network industries. The result is an outline of a theory of telecommunications networks that generates insights into important public policy debates, including mandatory access and network neutrality.

The book is organized as follows: The first part introduces the economics of networks. Chapter 1 considers the structure and functions of networks and introduces some basic ideas from graph theory. Chapter 2 examines the design and costs of networks and includes some basic concepts from engineering and economics. Chapter 3 studies the pricing of network services and efficient choice of capacity. It is not possible to give a complete overview of the vast fields of network mathematics, network engineering, and network economics. This book thus seeks

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simply to provide an introduction to networks and then to apply some of the basic concepts to the design of public policy.

The second part of the book presents a comprehensive overview of regulatory and antitrust approaches to network access. Chapter 4 examines the rationales traditionally invoked to justify regulation of communications networks, as well as the policy instruments used to implement these rationales. Chapter 5 looks at the transaction costs of providing access to networks. Chapter 6 examines market-based pricing of access to networks. Chapter 7 examines constitutional limits on the pricing of access to networks.

The third and final part of the book presents a set of four key policy applications. Chapter 8 analyzes the access to local telephone networks mandated by the Telecommunications Act of 1996. Chapter 9 examines how antitrust policy has addressed access to networks. Chapter 10 then studies access to local broadband networks, such as digital subscriber line (DSL) and cable modem systems, an issue that has been the focus of recent Supreme Court decisions and FCC proceedings. Chapters 11 and 12 address an issue known as “network neutrality,” which has emerged as the most controversial issue in Internet policy, applying the insights of the economics of product differentiation and congestion.

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- \_\_\_\_\_. 2005. "Network regulation: The many faces of access," *Journal of Competition Law and Economics* 1: 635–78.
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