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## Open Standards and the Digital Age

How did openness become a foundational value for the networks of the twenty-first century? *Open Standards and the Digital Age* answers this question through an interdisciplinary history of information networks that pays close attention to the politics of standardization. For much of the twentieth century, information networks such as the monopoly Bell System and the American military's Arpanet were closed systems subject to centralized control. In the 1970s and 1980s, however, engineers in the United States and Europe experimented with design strategies to create new digital networks. In the process, they embraced discourses of "openness" to describe their ideological commitments to entrepreneurship, technological innovation, and participatory democracy. The rhetoric of openness has flourished – for example, in movements for open government, open source software, and open access publishing – but such rhetoric also obscures the ways the Internet and other "open" systems still depend heavily on hierarchical forms of control.

Andrew L. Russell is an Assistant Professor of History and the Director of the Program in Science and Technology Studies in the College of Arts and Letters at the Stevens Institute of Technology in Hoboken, New Jersey. Before arriving at Stevens, he was a Postdoctoral Fellow in Duke University's John Hope Franklin Humanities Institute. Russell earned his PhD from Johns Hopkins University (2007), MA from the University of Colorado at Boulder (2003), and BA from Vassar College (1996). His work has been published in journals such as *IEEE Annals of the History of Computing*, *Enterprise & Society*, and *Information & Culture*. Russell has been awarded fellowships from the Charles Babbage Institute, the Association for Computing Machinery, the Institute for Electrical and Electronics Engineers, and the American Society for Information Science and Technology.

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The world economy has experienced a series of globalizations in the past two centuries, and each has been shaped by business enterprises, by their national political contexts, and by new sets of international institutions. Cambridge Studies in the Emergence of Global Enterprise focuses on those business firms that have given the global economy many of its most salient characteristics, particularly regarding how they have fostered new technology, new corporate cultures, new networks of communication, and new strategies and structures designed to meet global competition. All the while, they have accommodated to changes in national and international regulations, environmental standards, and cultural norms. This is a history that needs to be understood because we all have a stake in the performance and problems of global enterprise.

We are especially pleased to have Andrew L. Russell's *Open Standards and the Digital Age: History, Ideology, and Networks* in our series. The subject of open standards in the digital world of the Third Industrial Revolution is of importance to both scholars and those who frame public policy. There is a deep and broad movement calling for greater transparency and openness in all fields of modern science and technology. Yet, we have very few solidly researched studies of how, exactly, these demands play out, how the institutions they create evolve, and how the leaders of these organizations frame and re-frame their proposals. We have virtually no well-researched studies that place these developments in a comparative, historical framework. Russell's book achieves this goal, reaching back to the nineteenth-century roots of telecommunications and sweeping forward from telegraph to the telephone, from the monopoly Bell System through the digital transformation of the late twentieth century. In a world now dependent on electronic modes of communication and calculation, the power to shape standards is a crucial aspect of our economic, political, social, and cultural development.

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## *History, Ideology, and Networks*

ANDREW L. RUSSELL
*Stevens Institute of Technology*

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www.cambridge.org
Information on this title: www.cambridge.org/9781107612044

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First published 2014

Printed in the United States of America

*A catalog record for this publication is available from the British Library.*

*Library of Congress Cataloging in Publication data*
Russell, Andrew L., 1975–
Open standards and the digital age : history, ideology, and networks / Andrew L. Russell.
pages cm. – (Cambridge studies in the emergence of global enterprise)
Includes bibliographical references and index.
ISBN 978-1-107-03919-3 (hardback) – ISBN 978-1-107-61204-4 (paperback)
1. Standardization – United States – History. 2. Information technology – Standards – United States – History. 3. Telecommunication – Standards – United States – History. I. Title.
T59.2.U6R87 2014
602′.18–dc23 2013038663

ISBN 978-1-107-03919-3 Hardback
ISBN 978-1-107-61204-4 Paperback

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*To my father and mother, Lawrence Keith Russell and Carol Pereicich Russell.*

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# Acknowledgments

An astonishing number of people and institutions – teachers, friends, schools, and foundations – have helped me research and develop the ideas that I have tried to articulate in this book. I could not possibly list all of my intellectual debts here, but I am delighted to acknowledge the most substantial of them.

First, I am pleased to thank my colleagues at the University of Colorado at Boulder, Johns Hopkins University, Duke University, Stevens Institute of Technology, and in the professional communities that cluster around the Society for the History of Technology, the Business History Conference, and the Special Interest Group for Computers, Information, and Society. In particular, Bill Leslie and Louis Galambos patiently helped me pull meaning out of the acronym-laden snippets that I collected during my dissertation research. Conversations and correspondence with the following people also have improved my work immeasurably: Jane Anderson, Hyungsub Choi, John Day, Michael Aaron Dennis, Nathan Ensmenger, Margaret B. W. Graham, Thomas Haigh, Dale Hatfield, Sheldon Hochheiser, Richard R. John, Susan D. Jones, Robert H. Kargon, Sharon Kingsland, Harry Marks, Thomas J. Misa, Craig N. Murphy, Eric Nystrom, Mark Pittenger, James A. Schafer, Nick Smith, Daniel P. Todes, Steven W. Usselman, Philip J. Weiser, JoAnne Yates, and countless students in my classes at Stevens Institute of Technology. Three of my colleagues – James E. McClellan III, Valérie Schafer, and Lee Jared Vinsel – read multiple chapters of this manuscript as it was in progress, and their encouragement and gentle criticisms helped me at crucial moments. James Pelkey generously provided access to unique materials and interviews that he had collected, and gave me a flash of inspiration as I was revising the manuscript.

Despite euphoric claims that everything worth finding can now be found on the Internet, librarians and archivists still provide essential wisdom and support to help researchers find things that are not yet (or never will be) one or two clicks away. I wish I knew the names of all of the library staff



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at Colorado, Johns Hopkins, Duke, and the Herbert Hoover Presidential Library who handled my odd requests and late returns gracefully and charitably – you all have my deep appreciation. I would also like to thank Linda Beninghove, Adam Winger, and the inimitable Interlibrary Loan team at the S. C. Williams Library at Stevens Institute of Technology; William D. Caughlin at the AT&T Archives and History Center in San Antonio, Texas; George Kupczak at the AT&T Archives and History in Warren, New Jersey; Marc Weber at the Computer History Museum in Mountain View, California; and Katie Charlet, Arvid Nelson, and Stephanie Crowe at the Charles Babbage Institute for the History of Information Technology at the University of Minnesota, Minneapolis.

Archival research and historical scholarship are costly and time consuming, and the returns that come from investments in them do not generate quick or predictable profits (at least in the economic sense of the term). I am therefore very happy to acknowledge sources of financial support that have helped me complete this book: the Adelle and Erwin Tomash Fellowship in the History of Information Processing and the Arthur L. Norberg Travel Fund, both administered by the Charles Babbage Institute at the University of Minnesota; the Association for Computing Machinery History Committee; the American Society for Information Science & Technology History Fund; the John Hope Franklin Humanities Institute at Duke University; the IEEE Life Members Committee; the IEEE Computer Society History Committee; the College of Arts & Sciences and the Interdisciplinary Telecommunications Program at the University of Colorado; the Department of the History of Science and Technology at Johns Hopkins; and, most recently, the College of Arts & Letters at Stevens and its dedicated Dean Lisa Dolling.

I would like to thank Lewis Bateman and his team of editorial assistants at Cambridge University Press for their skill and patience as we turned my manuscript submission into a book. The anonymous reviewers commissioned by Cambridge University Press provided new insights and did their best to help me improve the manuscript. An earlier version of some material in Chapter 8 appeared as "'Rough Consensus and Running Code' and the Internet-OSI Standards War," *IEEE Annals of the History of Computing* 28 (2006): 48–61, and I am thankful for permission to reuse it.

Although the topic of standardization has the potential to "induce narcolepsy" (as an editor warned me long ago), I would like to thank the friends, family, and strangers who confirmed my instinct that such a mundane topic actually taps into deep human emotions and societal concerns. My sense of the meaning of standards and standardization – and not only in our present digital age – has been sharpened through endless hours of casual conversation about computers, cars, music, soccer, shower curtains, and so on. To those who have taken part in those conversations (you know who you are!): thank you.

Finally, I am lucky to have terrific friends and family who make my life richer and better in the moments when I have been contemplating this book

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and in the moments when I have set it aside. I am profoundly grateful for the friendship of Brian Shaw and Seth David Halvorson, and for the love of my wife, Lesley Bernier Russell. I dedicate this book to my parents, Larry and Carol Russell. The admiration, gratitude, and love I feel for them leave me at a loss for words.

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# Acronyms

| | |
|---|---|
| ACM | Association for Computing Machinery |
| AESC | American Engineering Standards Committee |
| AFNOR | Association Française de Normalisation |
| AIEE | American Institute of Electrical Engineers |
| AIME | American Institute of Mining Engineers |
| ANSI | American National Standards Institute |
| AREMWA | American Railroad Engineering and Maintenance of Way Association |
| ARPA | Advanced Research Projects Agency |
| ARPANET | Advanced Research Projects Agency Network |
| ASA | American Standards Association |
| ASCE | American Society of Civil Engineers |
| ASCII | American Standard Code for Information Interchange |
| ASME | American Society of Mechanical Engineers |
| ASTM | American Society for Testing Materials |
| AT&T | American Telephone and Telegraph |
| BBN | Bolt, Beranek and Newman |
| BESC | British Engineering Standards Committee |
| BSI | British Standards Institute |
| CCITT | International Telegraph and Telephone Consultative Committee |
| CIDR | Classless Inter-Domain Routing |
| CII | Compagnie Internationale pour l'Informatique |
| CLNP | ConnectionLess Network Protocol |
| CNET | Centre National d'Etudes des Telecommunications |
| CNRI | Corporation for National Research Initiatives |
| DARPA | Defense Advanced Research Projects Agency |
| DISY | Distributed Systems |



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| | |
|---|---|
| ECMA | European Computing Machinery Association |
| ECSA | Exchange Carriers Standards Association |
| FCC | Federal Communications Commission |
| FORTRAN | Formula Translating System |
| GEC | General Engineering Circular |
| GOSIP | Government Open Systems Interconnection Profile |
| HDNA | Honeywell Distributed Network Architecture |
| HDSA | Honeywell Distributed Systems Architecture |
| IAB | Internet Advisory Board (1984–1986) |
| IAB | Internet Activities Board (1986–1992) |
| IAB | Internet Architecture Board (1992–present) |
| IBM | International Business Machines |
| ICC | International Computation Centre |
| ICCB | Internet Configuration Control Board |
| IEC | International Electrotechnical Commission |
| IEEE | Institute of Electrical and Electronic Engineers |
| IESG | Internet Engineering Steering Group |
| IETF | Internet Engineering Task Force |
| IFIP | International Federation for Information Processing |
| IMP | Interface Message Processor |
| INARC | Internet Architecture Task Force |
| INWG | International Network Working Group |
| IP | Internet Protocol |
| IPRs | Intellectual Property Rights |
| IPTO | Information Processing Techniques Office |
| IRIA | Institut de Recherche en Informatique et en Automatique |
| ISO | International Organization for Standardization |
| ITU | International Telecommunications Union |
| MAP | Manufacturing Automation Protocol |
| MCI | Microwave Communications, Inc. |
| MIT | Massachusetts Institute of Technology |
| NCP | Network Control Program |
| NPL | National Physical Laboratory |
| NSF | National Science Foundation |
| NTEA | National Telephone Exchange Association |
| NWG | Network Working Group |
| OSI | Open Systems Interconnection |
| OSIC | Open Systems Interconnection Committee |
| PRnet | Packet Radio Network |
| PTT | Post, Telegraph, and Telephone |
| RCA | Radio Corporation of America |
| RFC | Request for Comments |
| ROAD | Routing and Addressing |
| SATnet | Satellite Radio Network |

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| | |
|---|---|
| SC | Subcommittee |
| SNA | System Network Architecture |
| SPARC | Standards Planning and Requirements Committee |
| TC | Technical Committee |
| TCP | Transmission Control Program (before 1977) |
| TCP | Transmission Control Protocol (after 1977) |
| TOP | Technical Office Protocol |
| UCLA | University of California, Los Angeles |
| UNESCO | United Nations Educational, Scientific, and Cultural Organization |
| W3C | World Wide Web Consortium |
| WG | Working Group |

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