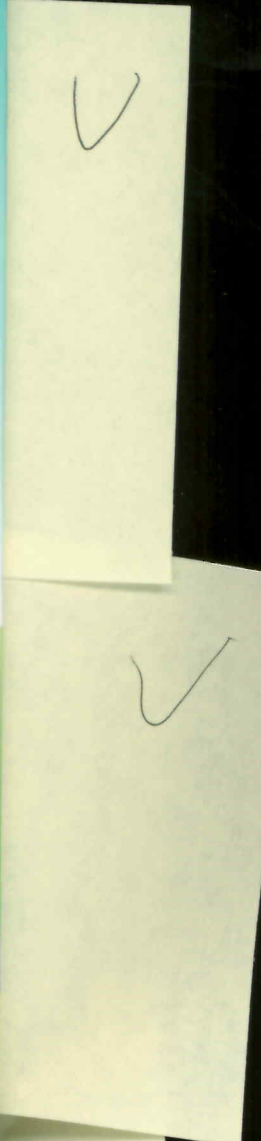


THIRD EDITION

COMPUTER NETWORKS

ANDREW S. TANENBAUM



Computer Networks

Third Edition

Andrew S. Tanenbaum

*Vrije Universiteit
Amsterdam, The Netherlands*

For book and bookstore information



<http://www.prenhall.com>



Prentice Hall PTR
Upper Saddle River, New Jersey 07458 M2M
Ex. 2003

Library of Congress Cataloging in Publication Data

Tanenbaum, Andrew S. 1944-

Computer networks / Andrew S. Tanenbaum. -- 3rd ed.

p. cm.

Includes bibliographical references and index.

ISBN 0-13-349945-6

I. Computer networks. I. Title.

TK5105.5.T36 1996

96-4121

004.6--dc20

CIP

Editorial/production manager: *Camille Trentacoste*

Interior design and composition: *Andrew S. Tanenbaum*

Cover design director: *Jerry Votta*

Cover designer: *Don Martinetti, DM Graphics, Inc.*

Cover concept: *Andrew S. Tanenbaum, from an idea by Marilyn Tremaine*

Interior graphics: *Hadel Studio*

Manufacturing manager: *Alexis R. Heydt*

Acquisitions editor: *Mary Franz*

Editorial Assistant: *Noreen Regina*



© 1996 by Prentice Hall PTR
Prentice-Hall, Inc.
A Simon & Schuster Company
Upper Saddle River, New Jersey 07458

The publisher offers discounts on this book when ordered in bulk quantities. For more information, contact:

Corporate Sales Department, Prentice Hall PTR, One Lake Street, Upper Saddle River, NJ 07458.
Phone: (800) 382-3419; Fax: (201) 236-7141. E-mail: corpsales@prenhall.com

All rights reserved. No part of this book may be reproduced, in any form or by any means, without permission in writing from the publisher.

All product names mentioned herein are the trademarks of their respective owners.

Printed in the United States of America

10 9 8 7 6 5

ISBN 0-13-349945-6

Prentice-Hall International (UK) Limited, *London*

Prentice-Hall of Australia Pty. Limited, *Sydney*

Prentice-Hall Canada Inc., *Toronto*

Prentice-Hall Hispanoamericana, S.A., *Mexico*

Prentice-Hall of India Private Limited, *New Delhi*

Prentice-Hall of Japan, Inc., *Tokyo*

Simon & Schuster Asia Pte. Ltd., *Singapore*

Editora Prentice-Hall do Brasil, Ltda., *Rio de Janeiro*

3

M2M
Ex. 2003

town, and the other one's wife was the town telephone operator. He quickly saw that either he was going to have to invent automatic telephone switching equipment or he was going to go out of business. He chose the first option. For nearly 100 years, the circuit switching equipment used worldwide was known as Strowger gear. (History does not record whether the now-unemployed switchboard operator got a job as an information operator, answering questions such as: What is the phone number of an undertaker?)

The model shown in Fig. 2-34(a) is highly simplified of course, because parts of the "copper" path between the two telephones may, in fact, be microwave links onto which thousands of calls are multiplexed. Nevertheless, the basic idea is valid: once a call has been set up, a dedicated path between both ends exists and will continue to exist until the call is finished.

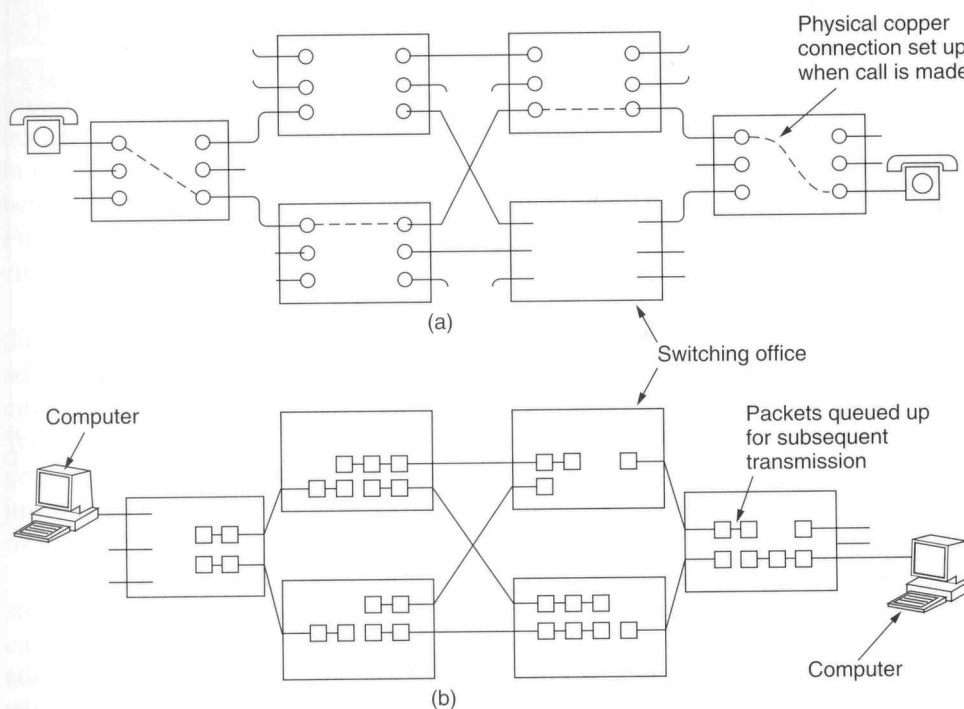


Fig. 2-34. (a) Circuit switching. (b) Packet switching.

An important property of circuit switching is the need to set up an end-to-end path *before* any data can be sent. The elapsed time between the end of dialing and the start of ringing can easily be 10 sec, more on long-distance or international calls. During this time interval, the telephone system is hunting for a copper path, as shown in Fig. 2-35(a). Note that before data transmission can even begin, the call request signal must propagate all the way to the destination, and be