

# Softswitch Architecture for VoIP

Franklin D. Ohrtman, Jr.

**McGraw-Hill**

New York Chicago San Francisco Lisbon  
London Madrid Mexico City Milan New Delhi  
San Juan Seoul Singapore Sydney Toronto

The McGraw-Hill Companies

**Cataloging-in-Publication Data is on file with the Library of Congress.**

Copyright © 2003 by The McGraw-Hill Companies, Inc. All rights reserved.  
Printed in the United States of America. Except as permitted under the United States Copyright Act of 1976, no part of this publication may be reproduced or distributed in any form or by any means, or stored in a data base or retrieval system, without the prior written permission of the publisher.

2 3 4 5 6 7 8 9 0 DOC/DOC 0 9 8 7 6 5 4

ISBN 0-07-140977-7

*The sponsoring editor for this book was Marjorie Spencer and the production supervisor was Pamela A. Pelton. It was set in New Century Schoolbook by MacAllister Publishing Services, LLC.*

*Printed and bound by RR Donnelley.*

McGraw-Hill books are available at special quantity discounts to use as premiums and sales promotions, or for use in corporate training programs. For more information, please write to the Director of Special Sales, Professional Publishing, McGraw-Hill, Two Penn Plaza, New York, NY 10121-2298. Or contact your local bookstore.

Information contained in this work has been obtained by The McGraw-Hill Companies, Inc. ("McGraw-Hill") from sources believed to be reliable. However, neither McGraw-Hill nor its authors guarantee the accuracy or completeness of any information published herein, and neither McGraw-Hill nor its authors shall be responsible for any errors, omissions, or damages arising out of use of this information. This work is published with the understanding that McGraw-Hill and its authors are supplying information but are not attempting to render engineering or other professional services. If such services are required, the assistance of an appropriate professional should be sought.



This book is printed on recycled, acid-free paper containing a minimum of 50 percent recycled de-inked fiber.



CHAPTER

# 4

## Voice over Internet Protocol



## What Is VoIP?

Softswitch is a product driven by the need to incorporate intelligence into *Voice over Internet Protocol* (VoIP) networks, interface IP networks, and the *Public Switched Telephone Network* (PSTN) and to coordinate features across networks. As outlined in the previous chapter, the first applications of softswitch were the gatekeepers (aka gateway controllers) that were incorporated in networks of VoIP gateways. In order to better understand a softswitched network, it is necessary to dissect VoIP down to the protocol level. Many volumes on VoIP can be found on the book market, and this book will not attempt to cover it in detail. The importance of VoIP protocols relative to softswitch is that they are the building blocks that make VoIP possible.

## Origins

In November 1988, Republic Telcom (yes, one “e”) of Boulder, Colorado, received patent number 4,782,485 for a “Multiplexed Digital Packet Telephone System.” The plaque from the Patent and Trademark Office describes it as follows: “A method for communicating speech signals from a first location to a second location over a digital communication medium comprising the steps of: providing a speech signal of predetermined bandwidth in analog signal format at said first location; periodically sampling said speech signal at a predetermined sampling rate to provide a succession of analog signal samples; representing said analog signal samples in a digital format thereby providing a succession of binary digital samples; dividing said succession of binary digital samples into groups of binary digital samples arranged in a temporal sequence; transforming at least two of said groups of binary digital samples into corresponding frames of digital compression.”

Republic and its acquiring company, Netrix Corporation, applied this voice over data technology to the data technologies of the times (X.25 and Frame Relay) until 1998 when Netrix and other competitors introduced VoIP onto their existing voice over data gateways. Although attempts at internet telephony had been done from a software-only perspective, commercial applications were limited to using voice over data gateways that could interface the PSTN to data networks. Voice over data applications were popular in enterprise networks with offices spread across the globe (eliminated international interoffice long-distance bills), offices where no PSTN existed (installations for mining and oil companies), and for long-distance bypasses (legitimate and illegitimate).



The popularity and applications of VoIP continued to grow. VoIP accounted for 6 percent of all international long-distance traffic in 2001.<sup>1</sup> Six percent may not seem like an exciting sum, but given a mere 3 years from the introduction of a technology to capturing 6 percent of a trillion dollar, 100-year-old industry, it is clear that VoIP will continue to capture more market share.

## How Does VoIP Work?

Softswitch is increasingly considered to be almost synonymous with VoIP. However, it also works with *Time Division Multiplexing* (TDM) and *Asynchronous Transfer Mode* (ATM) networks. The first process in an IP voice system is the digitization of the speaker's voice. The next step (and the first step when the user is on a handset connected to a gateway using a digital PSTN connection) is typically the suppression of unwanted signals and compression of the voice signal. This has two stages. First, the system examines the recently digitized information to determine if it contains voice signal or only ambient noise and discards any packets that do not contain speech. Secondly, complex algorithms are employed to reduce the amount of information that must be sent to the other party. Sophisticated codecs enable noise suppression and the compression of voice streams. Compression algorithms include G.723, G.728, and G.729.

Following compression, voice must be packetized and VoIP protocols added. Some storage of data occurs during the process of collecting voice data, since the transmitter must wait for a certain amount of voice data to be collected before it is combined to form a packet and transmitted via the network. Protocols are added to the packet to facilitate its transmission across the network. For example, each packet will need to contain the address of its destination, a sequencing number in case the packets do not arrive in the proper order, and additional data for error checking. Because IP is a protocol designed to interconnect networks of varying kinds, substantially more processing is required than in smaller networks. The network addressing system can often be very complex, requiring a process of encapsulating one packet inside another and, as data moves along, repackaging, readdressing, and reassembling the data.

---

<sup>1</sup>TeleGeography 2002—Global Traffic Statistics and Commentary," *TeleGeography*, 2001, [www.TeleGeography.com](http://www.TeleGeography.com).

# Explore Litigation Insights

Docket Alarm provides insights to develop a more informed litigation strategy and the peace of mind of knowing you're on top of things.

## Real-Time Litigation Alerts



Keep your litigation team up-to-date with **real-time alerts** and advanced team management tools built for the enterprise, all while greatly reducing PACER spend.

Our comprehensive service means we can handle Federal, State, and Administrative courts across the country.

## Advanced Docket Research



With over 230 million records, Docket Alarm's cloud-native docket research platform finds what other services can't. Coverage includes Federal, State, plus PTAB, TTAB, ITC and NLRB decisions, all in one place.

Identify arguments that have been successful in the past with full text, pinpoint searching. Link to case law cited within any court document via Fastcase.

## Analytics At Your Fingertips



Learn what happened the last time a particular judge, opposing counsel or company faced cases similar to yours.

Advanced out-of-the-box PTAB and TTAB analytics are always at your fingertips.

## API

Docket Alarm offers a powerful API (application programming interface) to developers that want to integrate case filings into their apps.

## LAW FIRMS

Build custom dashboards for your attorneys and clients with live data direct from the court.

Automate many repetitive legal tasks like conflict checks, document management, and marketing.

## FINANCIAL INSTITUTIONS

Litigation and bankruptcy checks for companies and debtors.

## E-DISCOVERY AND LEGAL VENDORS

Sync your system to PACER to automate legal marketing.