

Part of the five-volume
Networking Services Developer's Reference Library
微软网络编程与开发丛书

Microsoft® Press

微软独家授权 揭示微软网络技术内幕
深入网络编程与开发
IT 企业和网络编程人员必备

The essential reference set for developing with
Microsoft® Windows® networking technologies

David Iseminger

Series Editor

www.isevinger.com

Networking Services

[美] Microsoft 公司 著

RPC and Windows® Networking RPC 和 Windows 网络

(影印版)

北京大学出版社

<http://cbs.pku.edu.cn>

BASED ON
msdn™ library

微软网络编程与开发影印丛书

RPC and Windows Networking
RPC 和 Windows 网络

Microsoft 公司 著

北京大学出版社

内 容 简 介

本书是 NETWORKING SERVICES DEVELOPER'S REFERENCE LIBRARY (微软网络编程与开发影印丛书) 中的一本。简要介绍远端过程调用 (RPC) 以及 Windows 联网特性和功能。RPC 是一种强大的技术, 管理大多数网络协议与通信细节, 使您能够集中精力创建自己的应用程序而不必关心网络细节, 所以, RPC 简化了分布式客户/服务器的开发。Windows 联网技术使您能够在自己的应用程序中实现联网功能, 而不用考虑特定的网络提供商或物理网络实现方案。

Original English language edition Copyright © 2000 (year of first publication by author)

By Microsoft Corporation (author)

All rights published by arrangement with the original publisher, Microsoft Press, a division of Microsoft Corporation, Redmond, Washington, U.S.A.

北京市版权局著作权合同登记号: 图字 01-2000-0287

图书在版编目 (CIP) 数据

RPC 和 Windows 网络.第 3 卷: 英文/美国微软公司 (Microsoft) 著.—影印本.—北京: 北京大学出版社, 2000.4

ISBN 7-301-02040-6

I. R... II. 美... III. 窗口软件, Windows 2000-因特网-英文 IV. TP316.7

中国版本图书馆 CIP 数据核字 (2000) 第 07608 号

书 名: RPC 和 Windows 网络

责任著作者: Microsoft 公司 著

标 准 书 号: ISBN 7-301-02040-6/TP · 0169

出 版 者: 北京大学出版社

地 址: 北京市海淀区中关村北京大学校内 100871

网 址: <http://cbs.pku.edu.cn>

电 话: 出版部 62752015 发行部 62765126 62754140 编辑室 62765127

电 子 信 箱: wdzh@mail.263.net.cn

印 刷 者: 中国科学院印刷厂

发 行 者: 北京大学出版社

经 销 者: 新华书店

787 毫米×1092 毫米 16 开本 44 印张 1053 千字

2000 年 4 月第 1 版 2000 年 4 月第 1 次印刷

定 价: 118.00 元

前 言

在我们的生活和工作越来越离不开网络的今天，网络的速度、性能以及如何充分利用现有网络的容量都是至关重要的问题。Windows 2000 的几乎每一个新特性和新组件都必须直接或间接地使用网络。为了帮助用户最大限度地利用 Windows 2000 的网络特性，我们组织影印了这套 5 卷本的丛书，《微软网络编程与开发影印丛书》。本丛书可为编程人员提供完整的、考虑周全的参考资料。本丛书将最广泛使用的、最重要的和最及时的 Windows 网络技术信息搜集整理成册，便于开发人员开发更好的、与网络紧密集成的、在 Windows 平台上运行的应用程序。

本丛书的每一卷都侧重于 Windows 网络技术的不同领域，并结合 Windows 程序员的实际需要，精心编排了完整的索引，便于阅读和查找信息。本丛书的精心设计还有助于程序员方便地找到 Microsoft 的其他参考资料，包括印刷资料和电子版资料。每一本书还包括一个对整套丛书的概述，一个关于编程要素的附录，以及关于所引用的 Microsoft 技术的索引。但本丛书的内容远不止这些。本丛书是关于 Windows 网络特性、协议和服务的最佳资源。

本丛书的主编 David Iseminger 是 Microsoft 的独立顾问，作为网络和路由器性能分析师、通信专家和性能工具开发者，自 Windows NT 3.5 以来，他就一直从事 Windows NT 和 Windows 2000 的研究与开发工作。最近，他作为程序员，正在与开发人员文档组 (Developer Documentation Group) 一道，创建和维护 MSDN 建立的和新兴的网络技术，包括服务质量 (Quality of Service)。作为计算机图书作家，David 的著作颇丰，包括他最新创作、Microsoft 出版的《Active Directory Services for Microsoft Windows 2000 Technical Reference》。David 毕业于华盛顿大学，现居住在华盛顿州的 Puget Sound 城。欲详细了解 David 的工作以及本丛书的其他作品，请访问站点：www.iseminger.com。

本丛书由以下 5 本书组成：

- 《Windows Sockets and QOS》(《Winsock 和 QOS》)
- 《Network Protocols and Interface》(《网络协议和接口》)
- 《RPC and Windows Networking》(《RPC 和 Windows 网络》)
- 《Remote Access Services》(《远程访问服务》)
- 《Routing》(《路由》)

Contents

Acknowledgements	iii
Part 1	
Chapter 1: Getting Around in the Networking Services Library	1
How the Networking Services Library Is Structured	2
How the Networking Services Library Is Designed	3
Chapter 2: What's In This Volume?	5
Microsoft RPC Model	5
Installing The RPC Programming Environment	6
Building RPC Applications	6
Connecting the Client and the Server	6
Tutorial	6
IDL and ACF Files	6
Data and Language Features	6
Arrays and Pointers	6
Pipes	6
Binding and Handles	6
Memory Management	6
Serialization Services	6
Security	7
Installing and Configuring RPC Applications	7
Asynchronous RPC	7
RPC Message Queuing	7
Remote Procedure Calls Using HTTP	7
Samples	7
RPC Reference	7
Chapter 3: Using Microsoft Reference Resources	9
The Microsoft Developer Network	10
Comparing MSDN with MSDN Online	11
MSDN Subscriptions	13
MSDN Library Subscription	13
MSDN Professional Subscription	14
MSDN Universal Subscription	14

Purchasing an MSDN Subscription	14
Using MSDN	15
Navigating MSDN	16
Quick Tips	18
Using MSDN Online	20
Navigating MSDN Online	22
MSDN Online Features	23
MSDN Online Registered Users	29
The Windows Programming Reference Series	30
Chapter 4: Finding the Developer Resources You Need	31
Developer Support	31
Online Resources	33
Internet Standards	34
Learning Products	35
Conferences	37
Other Resources	37
Chapter 5: Avoiding Common RPC Programming Errors	39
Solution Summary	39
Common RPC Programming Errors	40
Pointer_default(unique) and embedded pointers	40
A valid switch_is value in an RPC-capable structure doesn't ensure a non-NULL pointer	41
A NULL DACL affords no protection	41
Call RpcImpersonateClient() before any security-relevant operation	42
Starting and stopping impersonation	43
Strings are only zero-terminated when declared with string in the .idl	44
Don't copy arbitrary length data into independently sized buffers	45
size_is may result in a zero-length structure	45
Calculations in a size_is or length_is specification are susceptible to overflow	46
Strict context handles	46

Part 2

Chapter 6: Microsoft RPC Model	47
The Programming Model	47
The Client-Server Model	49
The Compute-Server Model	51
How RPC Works	51

OSF Standards for RPC	53
Microsoft RPC Components	54
RPC Extends Client-Server Computing	55
Chapter 7: Installing the RPC Programming Environment	57
Developing 32-Bit Windows Applications	57
Developing Macintosh Client Applications	59
Chapter 8: Building RPC Applications	61
General Build Procedure	61
Developing the Interface	62
Generating Interface UUIDs	63
Using MIDL	64
Developing the Server	66
Developing the Client	67
Environment, Compiler, and API Set Choices	68
Exception Handling	69
Chapter 9: Connecting the Client and the Server	71
Essential RPC Binding Terminology	71
How the Server Prepares for a Connection	72
Registering the Interface	73
Creating Binding Information	73
Advertising the Server Program	74
Registering Endpoints	75
Listening for Client Calls	75
How the Client Establishes a Connection	76
Making a Remote Procedure Call	78
Finding the Server Host Computer	78
Finding the Server Program	79
Creating a Binding	79
Chapter 10: An RPC Tutorial	81
The Stand-Alone Application	81
Defining the Interface	82
Generating the UUID	82
The IDL File	83
The ACF File	83
Generating the Stub Files	84
The Client Application	86
The Server Application	88

Stopping the Server Application.....	90
Compiling and Linking.....	91
Running the Application	92
Chapter 11: The IDL and ACF Files	93
The Interface Definition Language (IDL) File	93
The IDL Interface Header	94
The IDL Interface Body	95
The Application Configuration File (ACF)	96
The ACF Header	96
The ACF Body.....	96
MIDL Compiler Output	97
Chapter 12: Data and Language Features	99
Strong Typing.....	99
Base Types	100
Signed and Unsigned Types.....	101
Wide-Character Types	101
Structures.....	101
Unions	101
Enumerated Types.....	103
Arrays.....	103
Function Attributes	103
Field Attributes	103
Three Pointer Types	104
Type Attributes.....	105
Directional (Parameter) Attributes.....	106
Data Representation	108
The transmit_as and represent_as Attributes.....	109
The transmit_as Attribute.....	109
The type_to_xmit Function	111
The type_from_xmit Function	112
The type_free_xmit Function	114
The type_free_inst Function	114
The represent_as Attribute	115
The named_type_from_local Function	118
The named_type_to_local Function.....	118
The named_type_free_local Function	118
The named_type_free_inst Function	118
The wire_marshall and user_marshall Attributes	119

The wire_marshal Attribute	119
The user_marshal Attribute	120
The type_UserSize Function	121
The type_UserMarshal Function	122
The type_UserUnmarshal Function	123
The type_UserFree Function	124
Marshaling Rules for user_marshal and wire_marshal	124
Chapter 13: Arrays and Pointers	127
Arrays and RPC	127
Kinds of Arrays	127
Fixed Arrays	127
Varying Arrays	128
Conformant Arrays	129
Array Attributes	130
MIDL Array Attributes Used in RPC	132
The [size_is] Attribute	132
The [length_is] Attribute	133
The [first_is] and [last_is] Attributes	133
The [max_is] Attribute	134
Combining Array Attributes	134
The [string] Attribute in Arrays	135
Multidimensional Arrays	135
Pointers and RPC	137
Kinds of Pointers	137
Reference Pointers	137
Unique Pointers	139
Full Pointers	140
Pointers and Memory Allocation	141
Default Pointer Types	142
Pointer-Attribute Type Inheritance	143
Using Arrays, Strings, and Pointers	144
Counted Character Arrays	145
[in, out, size_is] Prototype	145
[in, size_is and out, size_is] Prototype	146
Strings	147
[in, out, string] Prototype	148
[in, string] and [out, string] Prototype	149
Multiple Levels of Pointers	149

Chapter 14: Pipes	151
Essential Pipe Terminology	151
The Pipe State	152
Defining Pipes in IDL Files	152
Client-Side Pipe Implementation.....	153
Implementing Input Pipes on the Client	154
Implementing Output Pipes on the Client	157
Server-Side Pipe Implementation	159
Implementing Input Pipes on the Server.....	159
Implementing Output Pipes on the Server.....	160
Rules for Multiple Pipes	161
Combining Pipe and Nonpipe Parameters	162
 Chapter 15: Binding and Handles	 163
Binding Handles	163
Types of Binding Handles	163
Automatic Binding Handles.....	164
Implicit Binding Handles.....	165
Explicit Binding Handles	167
Primitive and Custom Binding Handles	167
Client-Side Binding	170
Selecting a Protocol Sequence.....	171
Finding Server Host Systems	172
Finding Endpoints	176
Server-Side Binding	177
Registering Interfaces	177
Specifying Protocol Sequences	186
Specifying Endpoints	187
Advertising Server Interfaces.....	189
Listening for Remote Procedure Calls	190
Fully and Partially Bound Handles	191
Interpreting Binding Information.....	191
Microsoft RPC Binding-Handle Extensions	193
Binding-Handle Functions.....	194
The RPC Name-Service Database	195
Name-Service Application Guidelines	196
An Overview of the Name Service Entry	197
Criteria for Name Service Entries	197
Name Service Entry Cleanup	198

What Happens During a Query	198
Using Microsoft Locator.....	199
Using the Cell Directory Service (CDS)	200
Name Syntax.....	201
Context Handles	201
Interface Development Using Context Handles	202
Server Development Using Context Handles.....	203
Client Development Using Context Handles	205
Server Context Rundown Routine.....	207
Client Context Reset	208
Multi-Threaded Clients and Context Handles	208
Chapter 16: Memory Management	209
Introduction to RPC Memory Management	209
How Memory Is Allocated and Deallocated	210
The midi_user_allocate Function	210
The midl_user_free Function.....	211
RpcSs Memory Management Package.....	212
Memory-Management Models.....	213
Node-by-Node Allocation and Deallocation	213
Stub-Allocated Buffers.....	214
Application-Allocated Buffer	214
Persistent Storage on the Server	215
Who Manages Memory?	216
Top-Level and Embedded Pointers.....	216
Directional Attributes Applied to the Parameter	216
Length, Size, and Directional Attributes	217
Pointer Attributes Applied to the Parameter.....	219
Combining Pointer and Directional Attributes	219
Embedded Out-Only Reference Pointers.....	219
Out-Only Unique or Full Pointer Parameters Not Accepted.....	220
Function Return Values.....	220
Memory Orphaning.....	221
Summary of Memory Allocation Rules	221
Chapter 17: Serialization Services	223
Using Serialization Services.....	224
Procedure Serialization	225
Type Serialization.....	225
Serialization Handles.....	226

Implicit Versus Explicit Handles	227
Serialization Styles.....	227
Fixed Buffer Serialization.....	228
Dynamic Buffer Serialization.....	230
Incremental Serialization.....	230
Obtaining an Encoding Identity	233
Chapter 18: Security	235
RPC Security Essentials	235
Principal Names	235
Authentication Levels	236
Authentication Services	237
Client Authentication Credentials.....	237
Authorization Services	237
Quality of Service	237
Authorization Functions	238
Key Acquisition Functions.....	239
Client Impersonation	239
Security Methods	240
Security Support Provider Interface (SSPI)	240
SSPI Architectural Overview.....	240
Security Support Providers (SSPs).....	241
Writing an Authenticated SSPI Client	242
Writing an Authenticated SSPI Server.....	245
Windows NT and Windows 2000 Transport Security	246
Using Transport-Level Security on the Server.....	247
Using Transport-Level Security on the Client	247
Chapter 19: Installing and Configuring RPC Applications.....	249
Configuring the Name Service Provider.....	249
Configuring the Name Service for Windows 95	250
Editing the Windows 95 Registry	250
Configuring the Name Service for Windows NT or Windows 2000	251
Configuring the Name Service for Windows 3.x or MS-DOS	252
Starting and Stopping Microsoft Locator.....	253
Registry Information	253
Using RPC Registry Entries.....	253
Configuring the Windows NT and Windows 2000 Registry for Port Allocations and Selective Binding	255
Using RPC with Winsock Proxy	257

SPX/IPX Installation	258
Configuring RPC for SPX/IPX	258
Configuring SAP and RPC	260
Configuring the Security Server	261
Chapter 20: Asynchronous RPC	263
Declaring Asynchronous Functions	264
Client-Side Asynchronous RPC	264
Making the Asynchronous Call	265
Waiting for the Asynchronous Reply	267
Receiving the Asynchronous Reply	268
Server-Side Asynchronous RPC	269
Handling Asynchronous Calls	269
Receiving Cancellations	269
Sending the Asynchronous Reply	269
Asynchronous I/O and Asynchronous RPC	271
Causal Ordering of Asynchronous Calls	272
Error Handling	272
Asynchronous RPC Over the Named-Pipe Protocol	273
Using Asynchronous RPC with DCE Pipes	274
Asynchronous Pipes	274
Declaring Asynchronous Pipes	274
Client-Side Asynchronous Pipe Handling	275
Server-Side Asynchronous Pipe Handling	276
Asynchronous DCOM	280
Chapter 21: RPC Message Queuing	281
Overview of Message Queuing Services Architecture	281
Message and Message Queue Properties	283
Using MSMQ as an RPC Transport	283
System Requirements for RPC-MQ Applications	284
Developing RPC-MQ Applications	284
MSMQ Security Services	286
Chapter 22: Remote Procedure Calls Using HTTP	287
Using HTTP as an RPC Transport	287
HTTP RPC Security	290
System Requirements for HTTP RPC	291
Configuring Computers for HTTP RPC	291
Chapter 23: RPC Samples	293

Chapter 24: RPC Data Types, Structures, and Constants.....	295
RPC Structures	295
RPC Enumerated Types	315
Other RPC Types.....	316
RPC Constants	329
RPC Return Values.....	340
 Chapter 25: RPC Function Reference	 347
RPC Functions	347
 Chapter 26: RPC Callback and Notification Functions.....	 575
 Chapter 27: RPC Macros	 583
 Chapter 28: Windows Networking (WNet)	 591
About Windows Networking	591
WNet Functions	592
Windows Networking Operations.....	594
Using Windows Networking	595
Using the Connections Dialog Box	595
Enumerating Network Resources	595
Adding a Network Connection	599
Assigning a Drive to a Share	600
Determining the Location of a Share	601
Retrieving the Connection Name	603
Retrieving the User Name.....	604
Canceling a Network Connection.....	605
Retrieving Network Errors.....	606
Windows Networking Reference.....	608
Windows Networking Functions.....	608
Obsolete Functions	608
Windows Networking Structures	656

Part 3

Glossary.....	669
 Index: Networking Services Programming Elements – Alphabetical Listing.....	 677

CHAPTER 1

Getting Around in the Networking Services Library

Networking is pervasive in this digital age in which we live. Information at your fingertips, distributed computing, name resolution, and indeed the entire Internet—the advent of which will be ascribed to our generation for centuries to come—imply and require networking. Everything that has become the buzz of our business and personal lives, including e-mail, cell phones, and Web surfing, is enabled by the fact that networking has been brought to the masses (and we've barely scraped the beginning of the trend). You, the network-enabled Windows application developer, need to know how to lasso this all-important networking services capability and make it a part of your application. You've come to the right place.

Networking isn't magic, but it can seem that way to those who aren't accustomed to it (or to the programmer who isn't familiar with the technologies or doesn't know how to make networking part of his or her application). That's why the *Networking Services Developer's Reference Library* isn't just a collection of programmatic reference information; it would be only half-complete if it were. Instead, the Networking Services Library is a collection of explanatory and reference information that combine to provide you with the complete set that you need to create today's network-enabled Windows application.

The Networking Services Library is *the* comprehensive reference guide to network-enabled application development. This library, like all libraries in the Windows Programming Reference Series (WPRS), is designed to deliver the most complete, authoritative, and accessible reference information available on a given subject of Windows network programming—without sacrificing focus. Each book in each library is dedicated to a logical group of technologies or development concerns; this approach has been taken specifically to enable you to find the information you need quickly, efficiently, and intuitively.

In addition to its networking services development information, the Networking Services Library contains tips designed to make your programming life easier. For example, a thorough explanation and detailed tour of MSDN Online is included, as is a section that helps you get the most out of your MSDN subscription. Just in case you don't have an MSDN subscription, or don't know why you should, I've included information about that too, including the differences between the three levels of MSDN subscription, what each level offers, and why you'd want a subscription when MSDN Online is available over the Internet.

To ensure that you don't get lost in all the information provided in the Networking Services Library, each volume's appendixes provide an all-encompassing programming directory to help you easily find the particular programming element you're looking for. This directory suite, which covers all the functions, structures, enumerations, and other programming elements found in network-enabled application development, gets you quickly to the volume and page you need, saving you hours of time and bucketsful of frustration.

How the Networking Services Library Is Structured

The Networking Services Library consists of five volumes, each of which focuses on a particular aspect of network programming. These programming reference volumes have been divided into the following:

- Volume 1: Winsock and QOS
- Volume 2: Network Interfaces and Protocols
- Volume 3: RPC and WNet
- Volume 4: Remote Access Services
- Volume 5: Routing

Dividing the Networking Services Library into these categories enables you to quickly identify the Networking Services volume you need, based on your task, and facilitates your maintenance of focus for that task. This approach enables you to keep one reference book open and handy, or tucked under your arm while researching that aspect of Windows programming on sandy beaches, without risking back problems (from toting around all 3,000+ pages of the Networking Services Library) and without having to shuffle among multiple less-focused books.

Within the Networking Services Library—and in fact, in all WPRS Libraries—each volume has a deliberate structure. This per-volume structure has been created to further focus the reference material in a developer-friendly manner, to maintain consistency within each volume and each Library throughout the series, and to enable you to easily gather the information you need. To that end, each volume in the Networking Services Library contains the following parts:

- Part 1: Introduction and Overview
- Part 2: Guides, Examples, and Programmatic Reference
- Part 3: Intelligently Structured Indexes

Part 1 provides an introduction to the Networking Services Library and to the WPRS (what you're reading now), and a handful of chapters designed to help you get the most out of networking technologies, MSDN, and MSDN Online. MSDN and WPRS Libraries are your tools in the developer process; knowing how to use them to their fullest will enable you to be more efficient and effective (both of which are generally desirable traits). In certain volumes (where appropriate), I've also provided additional information that you'll need in your network-enabled development efforts, and included such information as concluding chapters in Part 1. For example, Volume 3 includes a chapter that explains terms used throughout the RPC development documentation; by putting it into Chapter 5 of that volume, you always know where to go when you have a question about an RPC term. Some of the other volumes in the Networking Services Library conclude their Part 1 with chapters that include information crucial to their volume's contents, but I've been very selective about including such information. Publishing constraints have limited the amount of information I can provide in each volume (and in the library as a whole), so I've focused on the priority: getting you the most useful information possible within the number of pages I have to work with.

Part 2 contains the networking reference material particular to its volume. You'll notice that each volume contains *much* more than simple collections of function and structure definitions. A comprehensive reference resource should include information about how to use a particular technology, as well as definitions of programming elements. Consequently, the information in Part 2 combines complete programming element definitions with instructional and explanatory material for each programming area.

Part 3 is a collection of intelligently arranged and created indexes. One of the biggest challenges of the IT professional is finding information in the sea of available resources and network programming is probably one of the most complex and involved of any development discipline. In order to help you get a handle on network programming references (and Microsoft technologies in general), Part 3 puts all such information into an understandable, manageable directory (in the form of indexes) that enables you to quickly find the information you need.

How the Networking Services Library Is Designed

The Networking Services Library (and all libraries in the WPRS) is designed to deliver the most pertinent information in the most accessible way possible. The Networking Services Library is also designed to integrate seamlessly with MSDN and MSDN Online by providing a look and feel consistent with their electronic means of disseminating Microsoft reference information. In other words, the way a given function reference appears on the pages of this book has been designed specifically to emulate the way that MSDN and MSDN Online present their function reference pages.

The reason for maintaining such integration is simple: to make it easy for you to use the tools and get the ongoing information you need to create quality programs. Providing a "common interface" among reference resources allows your familiarity with the Networking Services Library reference material to be immediately applied to MSDN or MSDN Online, and vice-versa. In a word, it means *consistency*.