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TCP/IP 详解

卷3: T/TCP、HTTP、NNTP
和UNIX域协议 **英文版**

TCP/IP Illustrated

Volume 3: TCP for Transactions, HTTP,
NNTP, and the UNIX Domain Protocols

[美] W. Richard Stevens 著

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内 容 提 要

本书是TCP/IP领域的经典之作! 书中重点讲述高级协议, 覆盖了当今TCP/IP编程人员和网络管理员必须熟练掌握的T/TCP (TCP事务协议)、HTTP (超文本传送协议)、NNTP (网络新闻传送协议) 和Unix域协议。与前面两卷一样, 本书有丰富的例子和实现的细节。

本书适合希望了解TCP/IP协议如何实现的读者阅读, 是TCP/IP领域研究人员和开发人员的权威参考书。

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ACRONYMS

| | |
|---------|--|
| ACK | acknowledgment flag; TCP header |
| ANSI | American National Standards Institute |
| API | application program interface |
| ARP | Address Resolution Protocol |
| ARPANET | Advanced Research Projects Agency network |
| ASCII | American Standard Code for Information Interchange |
| | |
| BPF | BSD Packet Filter |
| BSD | Berkeley Software Distribution |
| | |
| CC | connection count; T/TCP |
| CERT | Computer Emergency Response Team |
| CR | carriage return |
| | |
| DF | don't fragment flag; IP header |
| DNS | Domain Name System |
| | |
| EOL | end of option list |
| | |
| FAQ | frequently asked question |
| FIN | finish flag; TCP header |
| FTP | File Transfer Protocol |
| | |
| GIF | graphics interchange format |
| | |
| HTML | Hypertext Markup Language |
| HTTP | Hypertext Transfer Protocol |
| | |
| ICMP | Internet Control Message Protocol |
| IEEE | Institute of Electrical and Electronics Engineers |
| INN | InterNet News |
| INND | InterNet News Daemon |
| IP | Internet Protocol |
| IPC | interprocess communication |
| IRTP | Internet Reliable Transaction Protocol |
| ISN | initial sequence number |
| ISO | International Organization for Standardization |
| ISS | initial send sequence number |
| | |
| LAN | local area network |
| LF | linefeed |
| | |
| MIME | multipurpose Internet mail extensions |
| MSL | maximum segment lifetime |
| MSS | maximum segment size |
| MTU | maximum transmission unit |

ACRONYMS

| | |
|--------|---|
| NCSA | National Center for Supercomputing Applications |
| NFS | Network File System |
| NNRP | Network News Reading Protocol |
| NNTP | Network News Transfer Protocol |
| NOAO | National Optical Astronomy Observatories |
| NOP | no operation |
| OSF | Open Software Foundation |
| OSI | open systems interconnection |
| PAWS | protection against wrapped sequence numbers |
| PCB | protocol control block |
| POSIX | Portable Operating System Interface |
| PPP | Point-to-Point Protocol |
| PSH | push flag; TCP header |
| RDP | Reliable Datagram Protocol |
| RFC | Request for Comment |
| RPC | remote procedure call |
| RST | reset flag; TCP header |
| RTO | retransmission time out |
| RTT | round-trip time |
| SLIP | Serial Line Internet Protocol |
| SMTP | Simple Mail Transfer Protocol |
| SPT | server processing time |
| SVR4 | System V Release 4 |
| SYN | synchronize sequence numbers flag; TCP header |
| TAO | TCP accelerated open |
| TCP | Transmission Control Protocol |
| TTL | time-to-live |
| Telnet | remote terminal protocol |
| UDP | User Datagram Protocol |
| URG | urgent pointer flag; TCP header |
| URI | uniform resource identifier |
| URL | uniform resource locator |
| URN | uniform resource name |
| VMTP | Versatile Message Transaction Protocol |
| WAN | wide area network |
| WWW | World Wide Web |

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献给我的几位导师，
我从他们身上学到了很多，特别是Jim Brault、
Dave Hanson、Bob Hunt和Brian Kernighan。

前 言

概述及本书的结构

本书是《TCP/IP详解》系列书的自然延续：[Stevens, 1994]，本书中称为卷1 (Volume 1)；[Wright and Stevens, 1995]，本书中称为卷2 (Volume 2)。本书可以分为三部分，每一部分包含一个不同的主题。

(1) TCP事务协议，一般简称T/TCP。这是TCP的扩展，用来使客户-服务器事务更快、更有效，同时也更加可靠。这是通过省略连接开始时的三次握手并缩短连接结束时的TIME_WAIT状态来实现的。我们将看到，对于客户-服务器事务，T/TCP可以达到UDP的性能，而T/TCP还提供了可靠性和适应性，这是与UDP相比的重要改进。

事务可以定义为客户端向服务器提出的请求以及服务器相应的应答。(术语“事务”指的不是包含加锁、两段提交和回退过程的数据库事务。)

(2) TCP/IP应用具体是指HTTP (超文本传送协议，万维网的基础)和NNTP (网络新闻传送协议，Usenet新闻系统的基础)。

(3) Unix域协议。所有的Unix TCP/IP实现都提供这些协议，许多非Unix实现也提供这些协议。它们提供了一种进程间通信 (IPC) 的形式，并使用与TCP/IP一样的套接字接口。当客户端和服务端在同一台主机上时，Unix域协议的速度一般是TCP/IP的两倍。

第一部分（T/TCP的描述）分为两块内容。第1章至第4章对这一协议进行了描述，并提供大量的示例说明其工作原理。卷1的24.7节曾对T/TCP进行了简单描述，本书的这部分内容对其进行了大幅扩展。第二块是第5章至第12章，描述的是4.4BSD-Lite网络代码（即卷2给出的代码）中T/TCP的实际实现。由于第一个T/TCP实现直到1994年9月才发布，而此时卷1已经出版一年，卷2也基本完成，因此T/TCP的示例和实现细节只能在本套书的这一卷中进行详细描述。

第二部分（HTTP和NNTP应用）是卷1的第25章至第30章介绍的TCP/IP应用的延续。在卷1出版后两年的时间里，HTTP技术随着因特网的兴起迅速流行开来，NNTP技术的使用在十几年时间中每年增长75%左右。由于常见的TCP使用方式是在数据交换极少的短连接里（连接的建立和销毁操作占用大部分时间），因此HTTP还是T/TCP的理想候补技术。在繁忙的Web服务器上由数以千计不同类型的客户大量使用HTTP（进而大量使用TCP）使我们可以检测服务器上的实际分组（第14章），并更好地理解卷1和卷2中描述的很多TCP/IP特性。

第三部分的Unix域协议本来是计划安排在卷2中的，但是由于卷2的篇幅已达到1200页，所以删掉了。在题为《TCP/IP详解》的一套书中讲述非TCP/IP协议看上去有点奇怪，但是Unix域协议早在将近15年前的4.2BSD版本中就首次实现了，与BSD TCP/IP的首次实现时间差不多。Berkeley衍生内核中大量使用了Unix域协议，但通常都是“在掩护下”使用的，大多数用户感觉不到它们的存在。除了作为Berkeley衍生内核中Unix管道的基础技术外，Unix域协议还大量用于客户和服务在同一台主机（常见的工作站）上的X Window系统。Unix域套接字技术用于在进程之间传递描述符，这是一种用于进程间通信的强大技术。由于Unix域协议中套接字API（应用程序接口）与TCP/IP中的套接字API几乎相同，因此只需要改动很少的代码，Unix域协议就可以轻松地提高应用程序的性能。

以上三部分内容可以独立阅读。

致读者

与前两卷相似，本卷面向所有希望了解TCP/IP协议运行原理的读者：编写网络应用的程序员、利用TCP/IP维护计算机系统与网络的系统管理员以及那些需要每天与TCP/IP应用打交道的用户。

前两部分内容要求读者对TCP/IP协议的工作原理有基本的了解。对TCP/IP协议不是很熟悉的读者首先应参考卷1[Stevens, 1994]，该书对TCP/IP协议族有比较透彻的讲述。第一部分的前一块内容（第1章至第4章，T/TCP基本概念及示例）可以独立于卷2阅读，但其余内容（第5~12章，T/TCP的实现）要求读者对卷2中提供的4.4BSD-Lite网络代码比较熟悉。

本书贯穿了一些交叉引用，不仅参考了本卷中的内容，还参考了卷1和卷2中相应的章节。本书提供了完整的索引，并把用到的所有缩略词及相应的复合术语都详细列在本

书的最前面。索引后还按照字母表顺序给出了书中所用到的结构体、函数和宏的交叉引用，以及相关详细信息的起始页码。当本卷的代码需要引用卷2中的内容时，交叉引用也会提及卷2中的相关定义。

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在展示交互式的输入和输出时，我们用粗体显示键入内容，以等宽正体显示计算机的输出，以斜体显示注释，示例如下：

```

sun % telnet www.aw.com 80      connect to the discard server
Trying 192.207.117.2...          this line and next output by Telnet client
Connected to aw.com.

```

另外，我们将系统名（本例中是sun）作为shell提示符的一部分，以表明命令正在哪种主机上运行。正文中提到的程序的名字通常用首字母大写（如Telnet和Tcpcdump）以避免过多的字体变化。

整本书中，我们随时会插入缩进的小字号段落来描述历史问题或实现细节。

致谢

首先我要感谢我的家人Sally、Bill、Ellen和David。在过去的一年中，他们又一次忍受了我外出旅行完成这本书的过程。不过，这一次做的确实是一本“小型”书。

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的基础。

还有一些人也提供了很重要的帮助。Gary Wright和Jim Hogue提供了第14章中采集数据所需要的系统。Doug Schmidt为第16章的时间度量提供了使用Unix域套接字的公共域TTCP程序的副本。Craig Partridge提供了一份RDP源代码的副本来帮助测试。Mike Karels解答了很多问题。

再次感谢美国国家光学天文台，尤其是授权我们接入其网络和主机的Sidney Wolff、Richard Wolff和Steve Grandi。

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跟以前一样，作者用James Clark编写的Groff包制作了本书的最终电子版——Troff硬拷贝。欢迎读者以电子邮件的方式反馈意见、提出建议或订正错误。

W. Richard Stevens

1995年11月于亚利桑那州图森市

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