TCP/IP Architecture, Design and Implementation in Linux. Practitioners

Description: This book provides thorough knowledge of Linux TCP/IP stack and kernel framework for its network stack, including complete knowledge of design and implementation. Starting with simple client-server socket programs and progressing to complex design and implementation of TCP/IP protocol in Linux, this book provides different aspects of socket programming and major TCP/IP related algorithms. In addition, the text features netfilter hook framework, a complete explanation of routing sub-system, IP QOS implementation, and Network Soft IRQ. This book further contains elements on TCP state machine implementation, TCP timer implementation on Linux, TCP memory management on Linux, and debugging TCP/IP stack using lcrash.

Contents:

Preface.

Acknowledgments.

1. INTRODUCTION.
   1.1 Overview of TCP/IP Stack.
   1.2 Source Code Organization for Linux 2.4.20.
   1.3 TCP/IP Stack and Kernel Control Paths.
   1.4 Linux Kernel Until Version 2.4 Is Non-preemptible.
   1.5 Linux Process and Thread.
   1.6 Kernel Synchronization Mechanism.
   1.7 Application Interfaces for TCP/IP Programming.
   1.8 Shutdown.
   1.9 I/O.
   1.10 TCP State.
   1.11 Summary.

2. PROTOCOL FUNDAMENTALS.
   2.1 TCP.
   2.2 TCP Options (RFC 1323).
   2.3 TCP Data Flow.
   2.4 Delayed Acknowledgment.
   2.5 Nagle’s Algorithm (RFC 896).
   2.6 TCP Sliding Window Protocol.
   2.7 Maximizing TCP Throughput.
   2.8 TCP Timers.
2.9 TCP Congestion Control.
2.10 TCP Performance and Reliability.
2.11 IP (Internet Protocol).
2.12 Routing.
2.13 netstat.
2.14 traceroute.
2.15 ICMP.
2.16 ping.
2.17 ARP/RARP.
2.18 Summary.
3. KERNEL IMPLEMENTATION OF SOCKETS.
3.1 Socket Layer.
3.2 VFS and Socket.
3.3 Protocol Socket Registration.
3.4 struct inet_protosw.
3.5 Socket Organization in the Kernel.
3.6 Socket.
3.7 inet_create.
3.8 Flow Diagram for Socket Call.
3.9 Summary.
4. KERNEL IMPLEMENTATION OF TCP CONNECTION SETUP.
4.1 Connection Setup.
4.2 Bind.
4.3 Listen.
4.4 Connection Request Handling by Kernel.
4.5 Accept.
4.6 Client Side Setup.
4.7 Summary.
5. sk_buff AND PROTOCOL HEADERS.
5.1 struct sk_buff.
5.2 struct skb_shared_info.
5.3 sk_buff and DMA—SKB_FRAG_STRUCT.
5.4 Routines Operating on sk_buff.
5.5 sk_buff Builds Protocol Headers as It Traverses Down the Protocol Layers.
5.6 sk_buff Extracts Protocol Headers as It Traverses Up the Protocol Layers When a Packet Arrives.
5.7 Summary.

6. MOVEMENT OF sk_buff ACROSS PROTOCOL LAYERS.
6.1 Packet Traversing Down the TCP/IP Stack.
6.3 Kernel Flow for a Packet Moving Down the Stack.
6.4 Packet Traversing Up the TCP/IP Stack.
6.5 Kernel Flow for a Packet Moving Up the Stack.
6.6 Summary.

7. TCP SEND.
7.1 TCP Segmentation Unit for Sending Data.
7.2 Segmentation with Scatter–Gather Technique.
7.3 Sending OOB Data.
7.4 Flow for TCP Segmentation Unit and Send Process.
7.5 Functional Level Flow for Segmentation and Send Mechanism.
7.6 Summary.

8. TCP RECEIVE.
8.1 Queuing Mechanism.
8.2 Processing of TCP Data from the Receive Queue.
8.3 TCP Urgent Byte Processing.
8.4 DATA Flow Diagram for Receiving Data over the TCP Socket.
8.5 Summary.

9. TCP MEMORY MANAGEMENT.
9.1 Transmit Side TCP Memory Management.
9.2 Receive Side TCP Memory Management.
9.3 Freeing of Memory Allocated to a Receive Buffer.
9.4 System-Wide Control Parameters Are Worth Noticing When It Comes to TCP Memory Management.
9.5 Summary.

10. TCP TIMERS.
10.2 TCP Retransmit Timer.
10.3 Zero Window Probe Timer.
10.4 Delay ACK Timer.
10.5 Keepalive Timer.
10.6 SYN-ACK Timer.
10.7 TIME_WAIT Timer.
10.7.8 __tcp_tw_hashdance().
10.8 Summary.

11. TCP CORE PROCESSING.
11.1 TCP Incoming Segment Processing.
11.2 Fast Path Processing.
11.3 Slow Path Processing.
11.4 Processing of Incoming ACK.
11.5 Processing of SACK blocks.
11.6 Reordering Length.
11.7 Processing TCP Urgent Pointer.
11.8 Processing Data Segments in Slow Path.
11.9 Overview of Core TCP Processing.
11.10 Summary.

12. TCP STATE PROCESSING.
12.1 Overview of State Processing.
12.2 TCP States.
12.3 Processing of Duplicate/Partial ACKs in Recovery State.
12.4 Processing of Duplicate/Partial ACKs in Loss State.
12.5 Default Processing of TCP States.
12.6 Processing of TCP Non-open States when ACKed Beyond tp ? high_seq.
12.7 Summary.

13. NETLINK SOCKETS.
13.1 Introduction to Netlink Sockets.
13.2 Netlink Socket Registration and Initialization at Boot Time.
13.3 How Is the Kernel Netlink Socket Created?
13.4 How Is the User Netlink Socket Created?
13.5 Netlink Data Structures.
13.6 Other Important Data Structures.
13.7 Netlink Packet Format.
13.8 Netlink Socket Example—tc Command for Adding a qdisc.
13.9 Flow Diagram for tc Command in Kernel Space.
13.10 Summary.

14. IP ROUTING.
14.1 Routing.
14.2 Policy-Based Routing.
14.3 Multipathing.
14.4 Record Route Options (RFC 791) and Processing by Linux Stack.
14.5 Source Routing.
14.6 Linux Kernel Implementation of Routing Table and Caches.
14.7 Routing Cache Implementation Overview.
14.8 Managing Routing Cache.
14.9 Implementation Overview of Forwarding Information Base (FIB).
14.10 Adding New Entry in Routing Table Using ip Command (RT Netlink Interface).
14.11 What Happens When the ip Command Is Run with a Rule Option for Adding an Entry in the Routing Table?
14.13 Summary.

15. IP QUALITY OF SERVICE IN LINUX (IP QoS).
15.1 Introduction.
15.2 Basic Components of Linux Traffic Control.
15.3 Linux Implementation of pfi fo_fast qdisc.
15.4 Queueing Discipline Data Structure.
15.5 tc User Program and Kernel Implementation Details.
15.6 The tc Commands for Creating Class Hierarchy for CBQ.
15.7 Filters.
15.8 u32 Filter Implementation.
15.9 Route Filter Implementation.
15.10 Enqueue.
15.11 Overview of Linux Implementation of CBQ.
15.12 cbq_dequeue().
15.13 Summary.
16. IP FILTER AND FIREWALL.
16.1 Netfilter Hook Framework.
16.2 Netfilter Hooks on IP Stack.
16.3 Overview of Netfilter Hooks on Linux TCP-IP Stack.
16.4 Registration of Netfilter Hooks.
16.5 Processing of Netfilter Hooks.
16.6 Compatibility Framework.
16.7 Ip Chains.
16.8 How Is the Packet Filtered with Ipchains.
16.9 Iptables.
16.10 Iptables Filter Rules and Target Organization.
16.11 Organization of Filter Rules and Target for Iptables.
16.12 Filtering Packets with Iptables.
16.13 Summary.
17. NET SOFTIRQ.
17.1 Why Net SoftIRQs, and How Do We Raise Them?
17.2 How Are SoftIRQs Are Processed, and When?
17.3 Registration of SoftIRQs.
17.4 Packet Reception and Delayed Processing by Rx SoftIRQ.
17.5 Processing of Net Rx SoftIRQ.
17.6 Packet Transmission and SoftIRQ.
17.7 Summary.
18. TRANSMISSION AND RECEPTION OF PACKETS.
18.1 DMA Ring Buffers for Transmission and Reception of Packets.
18.2 Packet Reception Process.
18.3 Packet Transmission Process.
18.5 Rx Interrupt for Reception of Packets.
18.6 Transmission of Packets.
18.7 Summary.
19. lkc AND DEBUGGING TCP/IP STACK.
19.1 lkc Source and Patches.
19.2 Touching the Socket.
19.3 Looking into the Receive Socket Buffer.
19.3.1 Route Information in sk_buff.
19.4 Peep into Send Socket Buffer.
19.5 TCP Segmentation Unit.
19.6 Send Congestion Window and ssthresh.
19.7 Retransmissions and Route.
19.8 Peeping into Connection Queues and SYN Queues.
19.9 Routing and IP Qos lcrash Steps.
19.10 CBQ (Class-Based) Queueing Discipline lcrash Steps.
19.11 U32 Filters.
19.12 Route Filters.
19.13 FIB Table lcrash Output for Setting Up the Realm Using ip Command.
19.15 Netlink Data Structure.
19.16 Summary.
20. NEXT EDITION.
Bibliography.
Index.

Ordering:
Order Online - http://www.researchandmarkets.com/reports/2174810/
Order by Fax - using the form below
Order by Post - print the order form below and send to

Research and Markets,
Guinness Centre,
Taylors Lane,
Dublin 8,
Ireland.
Fax Order Form
To place an order via fax simply print this form, fill in the information below and fax the completed form to 646-607-1907 (from USA) or +353-1-481-1716 (from Rest of World). If you have any questions please visit
http://www.researchandmarkets.com/contact/

Order Information
Please verify that the product information is correct.

<table>
<thead>
<tr>
<th>Product Name:</th>
<th>TCP/IP Architecture, Design and Implementation in Linux. Practitioners</th>
</tr>
</thead>
<tbody>
<tr>
<td>Web Address:</td>
<td><a href="http://www.researchandmarkets.com/reports/2174810/">http://www.researchandmarkets.com/reports/2174810/</a></td>
</tr>
<tr>
<td>Office Code:</td>
<td>SC231Y3W</td>
</tr>
</tbody>
</table>

Product Format
Please select the product format and quantity you require:

| Quantity | Hard Copy (Hard Back): | USD 133 + USD 28 Shipping/Handling |
* Shipping/Handling is only charged once per order.

Contact Information
Please enter all the information below in BLOCK CAPITALS

<table>
<thead>
<tr>
<th>Title:</th>
<th>Mr</th>
<th>Mrs</th>
<th>Dr</th>
<th>Miss</th>
<th>Ms</th>
<th>Prof</th>
</tr>
</thead>
<tbody>
<tr>
<td>First Name:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Last Name:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Email Address: *</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Job Title:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Organisation:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Address:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>City:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Postal / Zip Code:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Country:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Phone Number:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fax Number:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Please refrain from using free email accounts when ordering (e.g. Yahoo, Hotmail, AOL)
Payment Information

Please indicate the payment method you would like to use by selecting the appropriate box.

☐ Pay by credit card: You will receive an email with a link to a secure webpage to enter your credit card details.

☐ Pay by check: Please post the check, accompanied by this form, to:
Research and Markets,
Guinness Center,
Taylors Lane,
Dublin 8,
Ireland.

☐ Pay by wire transfer: Please transfer funds to:
Account number 833 130 83
Sort code 98-53-30
Swift code ULSBIE2D
IBAN number IE78ULSB98533083313083
Bank Address Ulster Bank,
27-35 Main Street,
Blackrock,
Co. Dublin,
Ireland.

If you have a Marketing Code please enter it below:

Marketing Code: ____________________________

Please note that by ordering from Research and Markets you are agreeing to our Terms and Conditions at http://www.researchandmarkets.com/info/terms.asp

Please fax this form to:
(646) 607-1907 or (646) 964-6609 - From USA
+353-1-481-1716 or +353-1-653-1571 - From Rest of World