



# Red Hat and IT Security

With Red Hat Ansible, Red Hat  
OpenShift, and Red Hat  
Security Auditing

---

Rithik Chatterjee

The Apress logo consists of the word "Apress" in a bold, black, sans-serif font, with a registered trademark symbol (®) at the end.

# **Red Hat and IT Security**

**With Red Hat Ansible, Red Hat  
OpenShift, and Red Hat  
Security Auditing**

**Rithik Chatterjee**

**Apress®**

## ***Red Hat and IT Security***

Rithik Chatterjee  
Pune, Maharashtra, India

ISBN-13 (pbk): 978-1-4842-6433-1  
<https://doi.org/10.1007/978-1-4842-6434-8>

ISBN-13 (electronic): 978-1-4842-6434-8

Copyright © 2021 by Rithik Chatterjee

This work is subject to copyright. All rights are reserved by the Publisher, whether the whole or part of the material is concerned, specifically the rights of translation, reprinting, reuse of illustrations, recitation, broadcasting, reproduction on microfilms or in any other physical way, and transmission or information storage and retrieval, electronic adaptation, computer software, or by similar or dissimilar methodology now known or hereafter developed.

Trademarked names, logos, and images may appear in this book. Rather than use a trademark symbol with every occurrence of a trademarked name, logo, or image we use the names, logos, and images only in an editorial fashion and to the benefit of the trademark owner, with no intention of infringement of the trademark.

The use in this publication of trade names, trademarks, service marks, and similar terms, even if they are not identified as such, is not to be taken as an expression of opinion as to whether or not they are subject to proprietary rights.

While the advice and information in this book are believed to be true and accurate at the date of publication, neither the authors nor the editors nor the publisher can accept any legal responsibility for any errors or omissions that may be made. The publisher makes no warranty, express or implied, with respect to the material contained herein.

Managing Director, Apress Media LLC: Welmoed Spahr

Acquisitions Editor: Divya Modi

Development Editor: Matthew Moodie

Coordinating Editor: Divya Modi

Cover designed by eStudioCalamar

Cover image designed by Pixabay

Distributed to the book trade worldwide by Springer Science+Business Media New York, 1 New York Plaza, Suite 4600, New York, NY 10004-1562, USA. Phone 1-800-SPRINGER, fax (201) 348-4505, e-mail [orders-ny@springer-sbm.com](mailto:orders-ny@springer-sbm.com), or visit [www.springeronline.com](http://www.springeronline.com).  
Apress Media, LLC is a California LLC and the sole member (owner) is Springer Science + Business Media Finance Inc (SSBM Finance Inc). SSBM Finance Inc is a **Delaware** corporation.

For information on translations, please e-mail [booktranslations@springernature.com](mailto:booktranslations@springernature.com); for reprint, paperback, or audio rights, please e-mail [bookpermissions@springernature.com](mailto:bookpermissions@springernature.com).

Apress titles may be purchased in bulk for academic, corporate, or promotional use. eBook versions and licenses are also available for most titles. For more information, reference our Print and eBook Bulk Sales web page at <http://www.apress.com/bulk-sales>.

Any source code or other supplementary material referenced by the author in this book is available to readers on GitHub via the book's product page, located at [www.apress.com/978-1-4842-6433-1](http://www.apress.com/978-1-4842-6433-1). For more detailed information, please visit <http://www.apress.com/source-code>.

Printed on acid-free paper

*This book is dedicated to my parents: Rita and Ashish;  
thank you for always supporting and encouraging me  
to pursue my ambitions.*

# Table of Contents

<b>About the Author .....</b>	xiii
<b>About the Technical Reviewer .....</b>	xv
<b>Acknowledgments .....</b>	xvii
<b>Introduction .....</b>	xix
<b>Chapter 1: Introduction to IT Security .....</b>	1
Basics of Networking .....	1
Firewalls .....	2
Virtual Private Network.....	2
Virtual Private Cloud .....	2
DHCP .....	3
Domain Name System .....	3
TCP .....	4
UDP .....	4
Simple Network Management Protocol.....	5
SSH.....	6
HTTP .....	6
SSL/TLS .....	7
Network Address Translation.....	7
Port Forwarding .....	8
IT Infrastructure Elements .....	8
Switching vs. Routing.....	8
Domain Controller.....	9

## TABLE OF CONTENTS

<b>Database Server .....</b>	<b>9</b>
<b>Application Server .....</b>	<b>10</b>
<b>Load Balancing Server .....</b>	<b>10</b>
<b>Linux System Administration Essential Concepts .....</b>	<b>10</b>
<b>Directory Services .....</b>	<b>11</b>
<b>LDAP .....</b>	<b>11</b>
<b>File Systems in Linux.....</b>	<b>13</b>
<b>Block Storage .....</b>	<b>15</b>
<b>Security Basics in Linux.....</b>	<b>15</b>
<b>Access Control Lists (ACLs) .....</b>	<b>15</b>
<b>SELinux.....</b>	<b>16</b>
<b>Firewall Daemon (Firewalld).....</b>	<b>18</b>
<b>Standardizing Security in Network and System Administration .....</b>	<b>20</b>
<b>Confidentiality.....</b>	<b>20</b>
<b>Integrity .....</b>	<b>20</b>
<b>Availability .....</b>	<b>21</b>
<b>Chapter 2: Red Hat Hybrid Cloud Infrastructure.....</b>	<b>23</b>
<b>Basics of Cloud Infrastructure.....</b>	<b>23</b>
<b>What Is Cloud Computing? .....</b>	<b>23</b>
<b>Cloud Computing Services .....</b>	<b>26</b>
<b>Cloud Bursting .....</b>	<b>30</b>
<b>Security in Cloud Infrastructure.....</b>	<b>31</b>
<b>Introduction to Hybrid Cloud Architecture .....</b>	<b>32</b>
<b>Operating Hybrid Clouds.....</b>	<b>34</b>
<b>Cloud First .....</b>	<b>37</b>
<b>Migration .....</b>	<b>38</b>
<b>Flexibility .....</b>	<b>40</b>
<b>Tiered Hybrid Strategy.....</b>	<b>40</b>

## TABLE OF CONTENTS

Benefits of Tiered Hybrid Implementation .....	41
Analytical Hybrid Infrastructure.....	42
Hybrid Edge Cloud Computing.....	42
Modern Hybrid Cloud Architecture .....	43
Security in Hybrid Clouds .....	44
<b>Red Hat Cloud Suite .....</b>	<b>45</b>
Red Hat CloudForms.....	46
Red Hat Virtualization .....	48
Red Hat OpenStack Platform .....	48
Red Hat OpenShift Container Platform .....	48
Advantages of CloudSuite.....	49
<b>Orchestration with Red Hat OpenShift .....</b>	<b>50</b>
OpenShift Container Platform (Red Hat OCP).....	51
Compatibility with Hybrid Cloud .....	51
OpenShift Security.....	52
Distinctive Features.....	53
Kubernetes .....	54
OCP Life Cycle .....	60
OCP Installation .....	61
Installation Procedure.....	62
<b>Chapter 3: Security in DevOps and Automation.....</b>	<b>65</b>
Categories of DevOps.....	65
Automation .....	66
Continuous Integration (CI) .....	66
Continuous Testing (CT) .....	66
Agile Development.....	67
Enterprise Systems Management (ESM).....	67

## TABLE OF CONTENTS

<b>Continuous Delivery vs. Continuous Deployment.....</b>	<b>68</b>
<b>Continuous Delivery (CD).....</b>	<b>68</b>
<b>Continuous Deployment (CD).....</b>	<b>68</b>
<b>Continuous Monitoring .....</b>	<b>69</b>
<b>Benefits of DevOps.....</b>	<b>70</b>
<b>Scalability .....</b>	<b>70</b>
<b>Speed .....</b>	<b>70</b>
<b>Innovation .....</b>	<b>71</b>
<b>Agility.....</b>	<b>71</b>
<b>Qualitative Growth .....</b>	<b>72</b>
<b>Reliability.....</b>	<b>72</b>
<b>Cost-Effective .....</b>	<b>72</b>
<b>Evolution of DevSecOps .....</b>	<b>72</b>
<b>DevSecOps in Environment and Data Security .....</b>	<b>77</b>
<b>DevSecOps in CI/CD Pipeline .....</b>	<b>78</b>
<b>Infrastructure as Code and Security as Code.....</b>	<b>80</b>
<b>Infrastructure as Code (IaC).....</b>	<b>80</b>
<b>Security as Code (SaC) .....</b>	<b>85</b>
<b>Automation with Red Hat Ansible Automation Platform.....</b>	<b>88</b>
<b>Ansible Components.....</b>	<b>90</b>
<b>Using Ansible .....</b>	<b>91</b>
<b>Building an Inventory.....</b>	<b>94</b>
<b>Default Groups.....</b>	<b>95</b>
<b>Ansible Playbook .....</b>	<b>99</b>
<b>DevSecOps in OpenShift .....</b>	<b>102</b>
<b>Red Hat Consulting .....</b>	<b>104</b>

## TABLE OF CONTENTS

<b>Chapter 4: Red Hat Hyperconverged Infrastructure.....</b>	<b>105</b>
Obsolescence of Legacy Infrastructure.....	105
What Is Hyperconverged Infrastructure? .....	106
HCI Architecture .....	109
Databases.....	111
Analytics and Logging .....	112
Data Security .....	112
Data Storage.....	113
Edge Computing .....	113
Desktop as a Service (DaaS) .....	114
Programming.....	114
General Uses .....	114
Red Hat Hyperconverged Infrastructure for Virtualization .....	115
Core Operations .....	117
Key Features.....	119
Red Hat Virtualization.....	119
Elements of Red Hat Virtualization .....	121
Security in Red Hat Virtualization .....	124
Configuration of sVirt.....	125
Flexibility with Red Hat Gluster Storage .....	126
Red Hat Hyperconverged Infrastructure for Cloud.....	135
Cloud Computing with Red Hat OpenStack Platform (RHOSP) .....	137
Scalability with Red Hat Ceph Storage.....	143
Hyperconverged Infrastructure Security Best Practices .....	146
Secure Individual Components.....	146
Security Centralization .....	147
Accessibility .....	148
Security Policies Implementation.....	148

## TABLE OF CONTENTS

<b>Chapter 5: Red Hat Smart Management and Red Hat Insights .....</b>	<b>149</b>
Red Hat Satellite Architecture .....	150
Core System Elements .....	154
Organizations.....	155
Locations .....	155
Life-Cycle Environments.....	156
Provisioning.....	156
Kickstart .....	157
PXE Booting .....	157
Infrastructure Controlling with Red Hat Smart Management.....	160
Predictive Analytics Using Red Hat Insights.....	162
Advisor Service.....	164
Vulnerability Service.....	167
Security Rules .....	168
Compliance Service.....	169
System Comparison / Drift Analysis .....	171
System Baselines .....	173
Reference Point .....	173
System Facts.....	174
Insights Policies.....	174
Webhooks .....	175
System Patching Using Ansible Playbooks.....	175
<b>Chapter 6: Red Hat Security Auditing .....</b>	<b>177</b>
IT System Auditing .....	177
General Controls vs. Application Controls .....	179
Risk Analysis .....	182
System Security .....	184

## TABLE OF CONTENTS

Control Objectives and Environment.....	184
Finding .....	185
Best Practices for Red Hat System Audit.....	186
RHEL Audit Use Cases .....	187
Audit Configuration.....	190
Evaluate Vulnerabilities and Verify Compliance.....	193
Conclusion .....	197
<b>Chapter 7: Case Studies.....</b>	<b>199</b>
Case Study 1: Anonymous.....	199
Context .....	199
Policies and Controls That Could Have Helped .....	201
Case Study 2: Sony Pictures Entertainment (2014).....	205
Context .....	205
Policies and Controls That Could Have Helped .....	207
Case Study 3: Capital One (2019).....	214
Context .....	214
Policies and Controls That Could Have Helped .....	217
Additional Case Studies .....	220
Bangladesh Bank Cyber Heist (2016) .....	220
Facebook–Cambridge Analytica Data Scandal (2018).....	221
Twitter Hack (2020) .....	221
<b>References.....</b>	<b>223</b>
<b>Index.....</b>	<b>225</b>