

VOLUME 1



THE PRACTICE OF SYSTEM AND NETWORK ADMINISTRATION

THIRD EDITION



THOMAS A. LIMONCELLI • CHRISTINA J. HOGAN • STRATA R. CHALUP

The Practice of System and Network Administration

Volume 1

Third Edition

Practice of System and Network Administration, The: Volume 1: DevOps and other Best Practices for Enterprise IT

Table of Contents

Cover

Title Page

Copyright Page

Contents at a Glance

Contents

Preface

Acknowledgments

About the Authors

Part I: Game-Changing Strategies

1 Climbing Out of the Hole

1.1 Organizing WIP

1.1.1 Ticket Systems

1.1.2 Kanban

1.1.3 Tickets and Kanban

1.2 Eliminating Time Sinkholes

1.2.1 OS Installation and Configuration

1.2.2 Software Deployment

1.3 DevOps

1.4 DevOps Without Devs

1.5 Bottlenecks

Table of Contents

1.6 Getting Started

1.7 Summary

Exercises

2 The Small Batches Principle

2.1 The Carpenter Analogy

2.2 Fixing Hell Month

2.3 Improving Emergency Failovers

2.4 Launching Early and Often

2.5 Summary

Exercises

3 Pets and Cattle

3.1 The Pets and Cattle Analogy

3.2 Scaling

3.3 Desktops as Cattle

3.4 Server Hardware as Cattle

3.5 Pets Store State

3.6 Isolating State

3.7 Generic Processes

3.8 Moving Variations to the End

3.9 Automation

3.10 Summary

Exercises

4 Infrastructure as Code

4.1 Programmable Infrastructure

4.2 Tracking Changes

4.3 Benefits of Infrastructure as Code

4.4 Principles of Infrastructure as Code

4.5 Configuration Management Tools

4.5.1 Declarative Versus Imperative

4.5.2 Idempotency

Table of Contents

4.5.3 Guards and Statements

4.6 Example Infrastructure as Code Systems

4.6.1 Configuring a DNS Client

4.6.2 A Simple Web Server

4.6.3 A Complex Web Application

4.7 Bringing Infrastructure as Code to Your Organization

4.8 Infrastructure as Code for Enhanced Collaboration

4.9 Downsides to Infrastructure as Code

4.10 Automation Myths

4.11 Summary

Exercises

Part II: Workstation Fleet Management

5 Workstation Architecture

5.1 Fungibility

5.2 Hardware

5.3 Operating System

5.4 Network Configuration

5.4.1 Dynamic Configuration

5.4.2 Hardcoded Configuration

5.4.3 Hybrid Configuration

5.4.4 Applicability

5.5 Accounts and Authorization

5.6 Data Storage

5.7 OS Updates

5.8 Security

5.8.1 Theft

5.8.2 Malware

5.9 Logging

5.10 Summary

Exercises

Table of Contents

6 Workstation Hardware Strategies

6.1 Physical Workstations

6.1.1 Laptop Versus Desktop

6.1.2 Vendor Selection

6.1.3 Product Line Selection

6.2 Virtual Desktop Infrastructure

6.2.1 Reduced Costs

6.2.2 Ease of Maintenance

6.2.3 Persistent or Non-persistent?

6.3 Bring Your Own Device

6.3.1 Strategies

6.3.2 Pros and Cons

6.3.3 Security

6.3.4 Additional Costs

6.3.5 Usability

6.4 Summary

Exercises

7 Workstation Software Life Cycle

7.1 Life of a Machine

7.2 OS Installation

7.3 OS Configuration

7.3.1 Configuration Management Systems

7.3.2 Microsoft Group Policy Objects

7.3.3 DHCP Configuration

7.3.4 Package Installation

7.4 Updating the System Software and Applications

7.4.1 Updates Versus Installations

7.4.2 Update Methods

7.5 Rolling Out Changes...Carefully

7.6 Disposal

7.6.1 Accounting

7.6.2 Technical: Decommissioning

Table of Contents

7.6.3 Technical: Data Security

7.6.4 Physical

7.7 Summary

Exercises

8 OS Installation Strategies

8.1 Consistency Is More Important Than Perfection

8.2 Installation Strategies

8.2.1 Automation

8.2.2 Cloning

8.2.3 Manual

8.3 Test-Driven Configuration Development

8.4 Automating in Steps

8.5 When Not to Automate

8.6 Vendor Support of OS Installation

8.7 Should You Trust the Vendors Installation?

8.8 Summary

Exercises

9 Workstation Service Definition

9.1 Basic Service Definition

9.1.1 Approaches to Platform Definition

9.1.2 Application Selection

9.1.3 Leveraging a CMDB

9.2 Refresh Cycles

9.2.1 Choosing an Approach

9.2.2 Formalizing the Policy

9.2.3 Aligning with Asset Depreciation

9.3 Tiered Support Levels

9.4 Workstations as a Managed Service

9.5 Summary

Exercises

10 Workstation Fleet Logistics

Table of Contents

10.1 What Employees See

10.2 What Employees Dont See

10.2.1 Purchasing Team

10.2.2 Prep Team

10.2.3 Delivery Team

10.2.4 Platform Team

10.2.5 Network Team

10.2.6 Tools Team

10.2.7 Project Management

10.2.8 Program Office

10.3 Configuration Management Database

10.4 Small-Scale Fleet Logistics

10.4.1 Part-Time Fleet Management

10.4.2 Full-Time Fleet Coordinators

10.5 Summary

Exercises

11 Workstation Standardization

11.1 Involving Customers Early

11.2 Releasing Early and Iterating

11.3 Having a Transition Interval (Overlap)

11.4 Ratcheting

11.5 Setting a Cut-Off Date

11.6 Adapting for Your Corporate Culture

11.7 Leveraging the Path of Least Resistance

11.8 Summary

Exercises

12 Onboarding

12.1 Making a Good First Impression

12.2 IT Responsibilities

12.3 Five Keys to Successful Onboarding

12.3.1 Drive the Process with an Onboarding Timeline

Table of Contents

- 12.3.2 Determine Needs Ahead of Arrival
- 12.3.3 Perform the Onboarding
- 12.3.4 Communicate Across Teams
- 12.3.5 Reflect On and Improve the Process

12.4 Cadence Changes

12.5 Case Studies

- 12.5.1 Worst Onboarding Experience Ever
- 12.5.2 Lumetas Onboarding Process
- 12.5.3 Googles Onboarding Process

12.6 Summary

Exercises

Part III: Servers

13 Server Hardware Strategies

13.1 All Eggs in One Basket

13.2 Beautiful Snowflakes

- 13.2.1 Asset Tracking
- 13.2.2 Reducing Variations
- 13.2.3 Global Optimization

13.3 Buyin Bulk, Allocate Fractions

- 13.3.1 VM Management
- 13.3.2 Live Migration
- 13.3.3 VM Packing
- 13.3.4 Spare Capacity for Maintenance
- 13.3.5 Unified VM/Non-VM Management
- 13.3.6 Containers

13.4 Grid Computing

13.5 Blade Servers

13.6 Cloud-Based Compute Services

- 13.6.1 What Is the Cloud?
- 13.6.2 Cloud Computings Cost Benefits
- 13.6.3 Software as a Service

13.7 Server Appliances

Table of Contents

13.8 Hybrid Strategies

13.9 Summary

Exercises

14 Server Hardware Features

14.1 Workstations Versus Servers

14.1.1 Server Hardware Design Differences

14.1.2 Server OS and Management Differences

14.2 Server Reliability

14.2.1 Levels of Redundancy

14.2.2 Data Integrity

14.2.3 Hot-Swap Components

14.2.4 Servers Should Be in Computer Rooms

14.3 Remotely Managing Servers

14.3.1 Integrated Out-of-Band Management

14.3.2 Non-integrated Out-of-Band Management

14.4 Separate Administrative Networks

14.5 Maintenance Contracts and Spare Parts

14.5.1 Vendor SLA

14.5.2 Spare Parts

14.5.3 Tracking Service Contracts

14.5.4 Cross-Shipping

14.6 Selecting Vendors with Server Experience

14.7 Summary

Exercises

15 Server Hardware Specifications

15.1 Models and Product Lines

15.2 Server Hardware Details

15.2.1 CPUs

15.2.2 Memory

15.2.3 Network Interfaces

15.2.4 Disks: Hardware Versus Software RAID

Table of Contents

15.2.5 Power Supplies

15.3 Things to Leave Out

15.4 Summary

Exercises

Part IV: Services

16 Service Requirements

16.1 Services Make the Environment

16.2 Starting with a Kick-Off Meeting

16.3 Gathering Written Requirements

16.4 Customer Requirements

16.4.1 Describing Features

16.4.2 Questions to Ask

16.4.3 Service Level Agreements

16.4.4 Handling Difficult Requests

16.5 Scope, Schedule, and Resources

16.6 Operational Requirements

16.6.1 System Observability

16.6.2 Remote and Central Management

16.6.3 Scaling Up or Out

16.6.4 Software Upgrades

16.6.5 Environment Fit

16.6.6 Support Model

16.6.7 Service Requests

16.6.8 Disaster Recovery

16.7 Open Architecture

16.8 Summary

Exercises

17 Service Planning and Engineering

17.1 General Engineering Basics

17.2 Simplicity

17.3 Vendor-Certified Designs

Table of Contents

17.4 Dependency Engineering

17.4.1 Primary Dependencies

17.4.2 External Dependencies

17.4.3 Dependency Alignment

17.5 Decoupling Hostname from Service Name

17.6 Support

17.6.1 Monitoring

17.6.2 Support Model

17.6.3 Service Request Model

17.6.4 Documentation

17.7 Summary

Exercises

18 Service Resiliency and Performance Patterns

18.1 Redundancy Design Patterns

18.1.1 Primary and Secondary

18.1.2 Load Balancers Plus Replicas

18.1.3 Replicas and Shared State

18.1.4 Performance or Resilience?

18.2 Performance and Scaling

18.2.1 Dataflow Analysis for Scaling

18.2.2 Bandwidth Versus Latency

18.3 Summary

Exercises

19 Service Launch: Fundamentals

19.1 Planning for Problems

19.2 The Six-Step Launch Process

19.2.1 Step 1: Define the Ready List

19.2.2 Step 2: Work the List

19.2.3 Step 3: Launch the Beta Service

19.2.4 Step 4: Launch the Production Service

19.2.5 Step 5: Capture the Lessons Learned

19.2.6 Step 6: Repeat

Table of Contents

19.3 Launch Readiness Review

19.3.1 Launch Readiness Criteria

19.3.2 Sample Launch Criteria

19.3.3 Organizational Learning

19.3.4 LRC Maintenance

19.4 Launch Calendar

19.5 Common Launch Problems

19.5.1 Processes Fail in Production

19.5.2 Unexpected Access Methods

19.5.3 Production Resources Unavailable

19.5.4 New Technology Failures

19.5.5 Lack of User Training

19.5.6 No Backups

19.6 Summary

Exercises

20 Service Launch: DevOps

20.1 Continuous Integration and Deployment

20.1.1 Test Ordering

20.1.2 Launch Categorizations

20.2 Minimum Viable Product

20.3 Rapid Release with Packaged Software

20.3.1 Testing Before Deployment

20.3.2 Time to Deployment Metrics

20.4 Cloning the Production Environment

20.5 Example: DNS/DHCP Infrastructure Software

20.5.1 The Problem

20.5.2 Desired End-State

20.5.3 First Milestone

20.5.4 Second Milestone

20.6 Launch with Data Migration

20.7 Controlling Self-Updating Software

20.8 Summary

Table of Contents

Exercises

21 Service Conversions

21.1 Minimizing Intrusiveness

21.2 Layers Versus Pillars

21.3 Vendor Support

21.4 Communication

21.5 Training

21.6 Gradual Roll-Outs

21.7 Flash-Cuts: Doing It All at Once

21.8 Backout Plan

21.8.1 Instant Roll-Back

21.8.2 Decision Point

21.9 Summary

Exercises

22 Disaster Recovery and Data Integrity

22.1 Risk Analysis

22.2 Legal Obligations

22.3 Damage Limitation

22.4 Preparation

22.5 Data Integrity

22.6 Redundant Sites

22.7 Security Disasters

22.8 Media Relations

22.9 Summary

Exercises

Part V: Infrastructure

23 Network Architecture

23.1 Physical Versus Logical

23.2 The OSI Model

Table of Contents

23.3 Wired Office Networks

23.3.1 Physical Infrastructure

23.3.2 Logical Design

23.3.3 Network Access Control

23.3.4 Location for Emergency Services

23.4 Wireless Office Networks

23.4.1 Physical Infrastructure

23.4.2 Logical Design

23.5 Datacenter Networks

23.5.1 Physical Infrastructure

23.5.2 Logical Design

23.6 WAN Strategies

23.6.1 Topology

23.6.2 Technology

23.7 Routing

23.7.1 Static Routing

23.7.2 Interior Routing Protocol

23.7.3 Exterior Gateway Protocol

23.8 Internet Access

23.8.1 Outbound Connectivity

23.8.2 Inbound Connectivity

23.9 Corporate Standards

23.9.1 Logical Design

23.9.2 Physical Design

23.10 Software-Defined Networks

23.11 IPv6

23.11.1 The Need for IPv6

23.11.2 Deploying IPv6

23.12 Summary

Exercises

24 Network Operations

24.1 Monitoring

Table of Contents

24.2 Management

- 24.2.1 Access and Audit Trail
- 24.2.2 Life Cycle
- 24.2.3 Configuration Management
- 24.2.4 Software Versions
- 24.2.5 Deployment Process

24.3 Documentation

- 24.3.1 Network Design and Implementation
- 24.3.2 DNS
- 24.3.3 CMDB
- 24.3.4 Labeling

24.4 Support

- 24.4.1 Tools
- 24.4.2 Organizational Structure
- 24.4.3 Network Services

24.5 Summary

Exercises

25 Datacenters Overview

25.1 Build, Rent, or Outsource

- 25.1.1 Building
- 25.1.2 Renting
- 25.1.3 Outsourcing
- 25.1.4 No Datacenter
- 25.1.5 Hybrid

25.2 Requirements

- 25.2.1 Business Requirements
- 25.2.2 Technical Requirements

25.3 Summary

Exercises

26 Running a Datacenter

26.1 Capacity Management

- 26.1.1 Rack Space

Table of Contents

26.1.2 Power

26.1.3 Wiring

26.1.4 Network and Console

26.2 Life-Cycle Management

26.2.1 Installation

26.2.2 Moves, Adds, and Changes

26.2.3 Maintenance

26.2.4 Decommission

26.3 Patch Cables

26.4 Labeling

26.4.1 Labeling Rack Location

26.4.2 Labeling Patch Cables

26.4.3 Labeling Network Equipment

26.5 Console Access

26.6 Workbench

26.7 Tools and Supplies

26.7.1 Tools

26.7.2 Spares and Supplies

26.7.3 Parking Spaces

26.8 Summary

Exercises

Part VI: Helpdesks and Support

27 Customer Support

27.1 Having a Helpdesk

27.2 Offering a Friendly Face

27.3 Reflecting Corporate Culture

27.4 Having Enough Staff

27.5 Defining Scope of Support

27.6 Specifying How to Get Help

27.7 Defining Processes for Staff

27.8 Establishing an Escalation Process

Table of Contents

- 27.9 Defining Emergency in Writing
- 27.10 Supplying Request-Tracking Software
- 27.11 Statistical Improvements
- 27.12 After-Hours and 24/7 Coverage
- 27.13 Better Advertising for the Helpdesk
- 27.14 Different Helpdesks for Different Needs
- 27.15 Summary
- Exercises

28 Handling an Incident Report

- 28.1 Process Overview
- 28.2 Phase A Step 1: The Greeting
- 28.3 Phase B: Problem Identification
 - 28.3.1 Step 2: Problem Classification
 - 28.3.2 Step 3: Problem Statement
 - 28.3.3 Step 4: Problem Verification
- 28.4 Phase C: Planning and Execution
 - 28.4.1 Step 5: Solution Proposals
 - 28.4.2 Step 6: Solution Selection
 - 28.4.3 Step 7: Execution
- 28.5 Phase D: Verification
 - 28.5.1 Step 8: Craft Verification
 - 28.5.2 Step 9: Customer Verification/Closing
- 28.6 Perils of Skipping a Step
- 28.7 Optimizing Customer Care
 - 28.7.1 Model-Based Training
 - 28.7.2 Holistic Improvement
 - 28.7.3 Increased Customer Familiarity
 - 28.7.4 Special Announcements for Major Outages
 - 28.7.5 Trend Analysis
 - 28.7.6 Customers Who Know the Process
 - 28.7.7 An Architecture That Reflects the Process

Table of Contents

28.8 Summary

Exercises

29 Debugging

29.1 Understanding the Customers Problem

29.2 Fixing the Cause, Not the Symptom

29.3 Being Systematic

29.4 Having the Right Tools

29.4.1 Training Is the Most Important Tool

29.4.2 Understanding the Underlying Technology

29.4.3 Choosing the Right Tools

29.4.4 Evaluating Tools

29.5 End-to-End Understanding of the System

29.6 Summary

Exercises

30 Fixing Things Once

30.1 Story: The Misconfigured Servers

30.2 Avoiding Temporary Fixes

30.3 Learn from Carpenters

30.4 Automation

30.5 Summary

Exercises

31 Documentation

31.1 What to Document

31.2 A Simple Template for Getting Started

31.3 Easy Sources for Documentation

31.3.1 Saving Screenshots

31.3.2 Capturing the Command Line

31.3.3 Leveraging Email

31.3.4 Mining the Ticket System

31.4 The Power of Checklists

Table of Contents

- 31.5 Wiki Systems
- 31.6 Findability
- 31.7 Roll-Out Issues
- 31.8 A Content-Management System
- 31.9 A Culture of Respect
- 31.10 Taxonomy and Structure
- 31.11 Additional Documentation Uses
- 31.12 Off-Site Links
- 31.13 Summary
- Exercises

Part VII: Change Processes

32 Change Management

- 32.1 Change Review Boards
- 32.2 Process Overview
- 32.3 Change Proposals
- 32.4 Change Classifications
- 32.5 Risk Discovery and Quantification
- 32.6 Technical Planning
- 32.7 Scheduling
- 32.8 Communication
- 32.9 Tiered Change Review Boards
- 32.10 Change Freezes
- 32.11 Team Change Management
 - 32.11.1 Changes Before Weekends
 - 32.11.2 Preventing Injured Toes
 - 32.11.3 Revision History
- 32.12 Starting with Git
- 32.13 Summary
- Exercises

33 Server Upgrades

Table of Contents

33.1 The Upgrade Process

33.2 Step 1: Develop a Service Checklist

33.3 Step 2: Verify Software Compatibility

33.3.1 Upgrade the Software Before the OS

33.3.2 Upgrade the Software After the OS

33.3.3 Postpone the Upgrade or Change the Software

33.4 Step 3: Develop Verification Tests

33.5 Step 4: Choose an Upgrade Strategy

33.5.1 Speed

33.5.2 Risk

33.5.3 End-User Disruption

33.5.4 Effort

33.6 Step 5: Write a Detailed Implementation Plan

33.6.1 Adding Services During the Upgrade

33.6.2 Removing Services During the Upgrade

33.6.3 Old and New Versions on the Same Machine

33.6.4 Performing a Dress Rehearsal

33.7 Step 6: Write a Backout Plan

33.8 Step 7: Select a Maintenance Window

33.9 Step 8: Announce the Upgrade

33.10 Step 9: Execute the Tests

33.11 Step 10: Lock Out Customers

33.12 Step 11: Do the Upgrade with Someone

33.13 Step 12: Test Your Work

33.14 Step 13: If All Else Fails, Back Out

33.15 Step 14: Restore Access to Customers

33.16 Step 15: Communicate Completion/Backout

33.17 Summary

Exercises

34 Maintenance Windows

34.1 Process Overview

Table of Contents

- 34.2 Getting Management Buy-In
- 34.3 Scheduling Maintenance Windows
- 34.4 Planning Maintenance Tasks
- 34.5 Selecting a Flight Director
- 34.6 Managing Change Proposals
 - 34.6.1 Sample Change Proposal: SecurID Server Upgrade
 - 34.6.2 Sample Change Proposal: Storage Migration
- 34.7 Developing the Master Plan
- 34.8 Disabling Access
- 34.9 Ensuring Mechanics and Coordination
 - 34.9.1 Shutdown/Boot Sequence
 - 34.9.2 KVM, Console Service, and LOM
 - 34.9.3 Communications
- 34.10 Change Completion Deadlines
- 34.11 Comprehensive System Testing
- 34.12 Post-maintenance Communication
- 34.13 Reenabling Remote Access
- 34.14 Be Visible the Next Morning
- 34.15 Postmortem
- 34.16 Mentoring a New Flight Director
- 34.17 Trending of Historical Data
- 34.18 Providing Limited Availability
- 34.19 High-Availability Sites
 - 34.19.1 The Similarities
 - 34.19.2 The Differences
- 34.20 Summary
- Exercises

35 Centralization Overview

- 35.1 Rationale for Reorganizing
 - 35.1.1 Rationale for Centralization
 - 35.1.2 Rationale for Decentralization

Table of Contents

35.2 Approaches and Hybrids

35.3 Summary

Exercises

36 Centralization Recommendations

36.1 Architecture

36.2 Security

36.2.1 Authorization

36.2.2 Extranet Connections

36.2.3 Data Leakage Prevention

36.3 Infrastructure

36.3.1 Datacenters

36.3.2 Networking

36.3.3 IP Address Space Management

36.3.4 Namespace Management

36.3.5 Communications

36.3.6 Data Management

36.3.7 Monitoring

36.3.8 Logging

36.4 Support

36.4.1 Helpdesk

36.4.2 End-User Support

36.5 Purchasing

36.6 Lab Environments

36.7 Summary

Exercises

37 Centralizing a Service

37.1 Understand the Current Solution

37.2 Make a Detailed Plan

37.3 Get Management Support

37.4 Fix the Problems

37.5 Provide an Excellent Service

Table of Contents

- 37.6 Start Slowly
- 37.7 Look for Low-Hanging Fruit
- 37.8 When to Decentralize
- 37.9 Managing Decentralized Services
- 37.10 Summary
- Exercises

Part VIII: Service Recommendations

38 Service Monitoring

- 38.1 Types of Monitoring
- 38.2 Building a Monitoring System
- 38.3 Historical Monitoring
 - 38.3.1 Gathering the Data
 - 38.3.2 Storing the Data
 - 38.3.3 Viewing the Data
- 38.4 Real-Time Monitoring
 - 38.4.1 SNMP
 - 38.4.2 Log Processing
 - 38.4.3 Alerting Mechanism
 - 38.4.4 Escalation
 - 38.4.5 Active Monitoring Systems
- 38.5 Scaling
 - 38.5.1 Prioritization
 - 38.5.2 Cascading Alerts
 - 38.5.3 Coordination
- 38.6 Centralization and Accessibility
- 38.7 Pervasive Monitoring
- 38.8 End-to-End Tests
- 38.9 Application Response Time Monitoring
- 38.10 Compliance Monitoring
- 38.11 Meta-monitoring
- 38.12 Summary

Table of Contents

Exercises

39 Namespaces

39.1 What Is a Namespace?

39.2 Basic Rules of Namespaces

39.3 Defining Names

39.4 Merging Namespaces

39.5 Life-Cycle Management

39.6 Reuse

39.7 Usage

39.7.1 Scope

39.7.2 Consistency

39.7.3 Authority

39.8 Federated Identity

39.9 Summary

Exercises

40 Nameservices

40.1 Nameservice Data

40.1.1 Data

40.1.2 Consistency

40.1.3 Authority

40.1.4 Capacity and Scaling

40.2 Reliability

40.2.1 DNS

40.2.2 DHCP

40.2.3 LDAP

40.2.4 Authentication

40.2.5 Authentication, Authorization, and Accounting

40.2.6 Databases

40.3 Access Policy

40.4 Change Policies

40.5 Change Procedures

Table of Contents

40.5.1 Automation

40.5.2 Self-Service Automation

40.6 Centralized Management

40.7 Summary

Exercises

41 Email Service

41.1 Privacy Policy

41.2 Namespaces

41.3 Reliability

41.4 Simplicity

41.5 Spam and Virus Blocking

41.6 Generality

41.7 Automation

41.8 Monitoring

41.9 Redundancy

41.10 Scaling

41.11 Security Issues

41.12 Encryption

41.13 Email Retention Policy

41.14 Communication

41.15 High-Volume List Processing

41.16 Summary

Exercises

42 Print Service

42.1 Level of Centralization

42.2 Print Architecture Policy

42.3 Documentation

42.4 Monitoring

42.5 Environmental Issues

42.6 Shredding

Table of Contents

42.7 Summary

Exercises

43 Data Storage

43.1 Terminology

43.1.1 Key Individual Disk Components

43.1.2 RAID

43.1.3 Volumes and File Systems

43.1.4 Directly Attached Storage

43.1.5 Network-Attached Storage

43.1.6 Storage-Area Networks

43.2 Managing Storage

43.2.1 Reframing Storage as a Community Resource

43.2.2 Conducting a Storage-Needs Assessment

43.2.3 Mapping Groups onto Storage Infrastructure

43.2.4 Developing an Inventory and Spares Policy

43.2.5 Planning for Future Storage

43.2.6 Establishing Storage Standards

43.3 Storage as a Service

43.3.1 A Storage SLA

43.3.2 Reliability

43.3.3 Backups

43.3.4 Monitoring

43.3.5 SAN Caveats

43.4 Performance

43.4.1 RAID and Performance

43.4.2 NAS and Performance

43.4.3 SSDs and Performance

43.4.4 SANs and Performance

43.4.5 Pipeline Optimization

43.5 Evaluating New Storage Solutions

43.5.1 Drive Speed

43.5.2 Fragmentation

Table of Contents

43.5.3 Storage Limits: Disk Access Density Gap

43.5.4 Continuous Data Protection

43.6 Common Data Storage Problems

43.6.1 Large Physical Infrastructure

43.6.2 Timeouts

43.6.3 Saturation Behavior

43.7 Summary

Exercises

44 Backup and Restore

44.1 Getting Started

44.2 Reasons for Restores

44.2.1 Accidental File Deletion

44.2.2 Disk Failure

44.2.3 Archival Purposes

44.2.4 Perform Fire Drills

44.3 Corporate Guidelines

44.4 A Data-Recovery SLA and Policy

44.5 The Backup Schedule

44.6 Time and Capacity Planning

44.6.1 Backup Speed

44.6.2 Restore Speed

44.6.3 High-Availability Databases

44.7 Consumables Planning

44.7.1 Tape Inventory

44.7.2 Backup Media and Off-Site Storage

44.8 Restore-Process Issues

44.9 Backup Automation

44.10 Centralization

44.11 Technology Changes

44.12 Summary

Exercises

Table of Contents

45 Software Repositories

45.1 Types of Repositories

45.2 Benefits of Repositories

45.3 Package Management Systems

45.4 Anatomy of a Package

45.4.1 Metadata and Scripts

45.4.2 Active Versus Dormant Installation

45.4.3 Binary Packages

45.4.4 Library Packages

45.4.5 Super-Packages

45.4.6 Source Packages

45.5 Anatomy of a Repository

45.5.1 Security

45.5.2 Universal Access

45.5.3 Release Process

45.5.4 Multitiered Mirrors and Caches

45.6 Managing a Repository

45.6.1 Repackaging Public Packages

45.6.2 Repackaging Third-Party Software

45.6.3 Service and Support

45.6.4 Repository as a Service

45.7 Repository Client

45.7.1 Version Management

45.7.2 Tracking Conflicts

45.8 Build Environment

45.8.1 Continuous Integration

45.8.2 Hermetic Build

45.9 Repository Examples

45.9.1 Staged Software Repository

45.9.2 OS Mirror

45.9.3 Controlled OS Mirror

45.10 Summary

Table of Contents

Exercises

46 Web Services

46.1 Simple Web Servers

46.2 Multiple Web Servers on One Host

46.2.1 Scalable Techniques

46.2.2 HTTPS

46.3 Service Level Agreements

46.4 Monitoring

46.5 Scaling for Web Services

46.5.1 Horizontal Scaling

46.5.2 Vertical Scaling

46.5.3 Choosing a Scaling Method

46.6 Web Service Security

46.6.1 Secure Connections and Certificates

46.6.2 Protecting the Web Server Application

46.6.3 Protecting the Content

46.6.4 Application Security

46.7 Content Management

46.8 Summary

Exercises

Part IX: Management Practices

47 Ethics

47.1 Informed Consent

47.2 Code of Ethics

47.3 Customer Usage Guidelines

47.4 Privileged-Access Code of Conduct

47.5 Copyright Adherence

47.6 Working with Law Enforcement

47.7 Setting Expectations on Privacy and Monitoring

47.8 Being Told to Do Something Illegal/Unethical

Table of Contents

47.9 Observing Illegal Activity

47.10 Summary

Exercises

48 Organizational Structures

48.1 Sizing

48.2 Funding Models

48.3 Management Chains Influence

48.4 Skill Selection

48.5 Infrastructure Teams

48.6 Customer Support

48.7 Helpdesk

48.8 Outsourcing

48.9 Consultants and Contractors

48.10 Sample Organizational Structures

48.10.1 Small Company

48.10.2 Medium-Size Company

48.10.3 Large Company

48.10.4 E-commerce Site

48.10.5 Universities and Nonprofit Organizations

48.11 Summary

Exercises

49 Perception and Visibility

49.1 Perception

49.1.1 A Good First Impression

49.1.2 Attitude, Perception, and Customers

49.1.3 Aligning Priorities with Customer Expectations

49.1.4 The System Advocate

49.2 Visibility

49.2.1 System Status Web Page

49.2.2 Management Meetings

49.2.3 Physical Visibility

Table of Contents

49.2.4 Town Hall Meetings

49.2.5 Newsletters

49.2.6 Mail to All Customers

49.2.7 Lunch

49.3 Summary

Exercises

50 Time Management

50.1 Interruptions

50.1.1 Stay Focused

50.1.2 Splitting Your Day

50.2 Follow-Through

50.3 Basic To-Do List Management

50.4 Setting Goals

50.5 Handling Email Once

50.6 Precompiling Decisions

50.7 Finding Free Time

50.8 Dealing with Ineffective People

50.9 Dealing with Slow Bureaucrats

50.10 Summary

Exercises

51 Communication and Negotiation

51.1 Communication

51.2 I Statements

51.3 Active Listening

51.3.1 Mirroring

51.3.2 Summary Statements

51.3.3 Reflection

51.4 Negotiation

51.4.1 Recognizing the Situation

51.4.2 Format of a Negotiation Meeting

51.4.3 Working Toward a Win-Win Outcome

Table of Contents

51.4.4 Planning Your Negotiations

51.5 Additional Negotiation Tips

51.5.1 Ask for What You Want

51.5.2 Dont Negotiate Against Yourself

51.5.3 Dont Reveal Your Strategy

51.5.4 Refuse the First Offer

51.5.5 Use Silence as a Negotiating Tool

51.6 Further Reading

51.7 Summary

Exercises

52 Beinga Happy SA

52.1 Happiness

52.2 Accepting Criticism

52.3 Your Support Structure

52.4 Balancing Work and Personal Life

52.5 Professional Development

52.6 Staying Technical

52.7 Loving Your Job

52.8 Motivation

52.9 Managing Your Manager

52.10 Self-Help Books

52.11 Summary

Exercises

53 Hiring System Administrators

53.1 Job Description

53.2 Skill Level

53.3 Recruiting

53.4 Timing

53.5 Team Considerations

53.6 The Interview Team

Table of Contents

53.7 Interview Process

53.8 Technical Interviewing

53.9 Nontechnical Interviewing

53.10 Selling the Position

53.11 Employee Retention

53.12 Getting Noticed

53.13 Summary

Exercises

54 Firing System Administrators

54.1 Cooperate with Corporate HR

54.2 The Exit Checklist

54.3 Removing Access

54.3.1 Physical Access

54.3.2 Remote Access

54.3.3 Application Access

54.3.4 Shared Passwords

54.3.5 External Services

54.3.6 Certificates and Other Secrets

54.4 Logistics

54.5 Examples

54.5.1 Amicably Leaving a Company

54.5.2 Firing the Boss

54.5.3 Removal at an Academic Institution

54.6 Supporting Infrastructure

54.7 Summary

Exercises

Part X: Being More Awesome

55 Operational Excellence

55.1 What Does Operational Excellence Look Like?

55.2 How to Measure Greatness

Table of Contents

55.3 Assessment Methodology

55.3.1 Operational Responsibilities

55.3.2 Assessment Levels

55.3.3 Assessment Questions and Look-Fors

55.4 Service Assessments

55.4.1 Identifying What to Assess

55.4.2 Assessing Each Service

55.4.3 Comparing Results Across Services

55.4.4 Acting on the Results

55.4.5 Assessment and Project Planning Frequencies

55.5 Organizational Assessments

55.6 Levels of Improvement

55.7 Getting Started

55.8 Summary

Exercises

56 Operational Assessments

56.1 Regular Tasks (RT)

56.2 Emergency Response (ER)

56.3 Monitoring and Metrics (MM)

56.4 Capacity Planning (CP)

56.5 Change Management (CM)

56.6 New Product Introduction and Removal (NPI/NPR)

56.7 Service Deployment and Decommissioning (SDD)

56.8 Performance and Efficiency (PE)

56.9 Service Delivery: The Build Phase

56.10 Service Delivery: The Deployment Phase

56.11 Toil Reduction

56.12 Disaster Preparedness

Epilogue

Part XI: Appendices

Table of Contents

A: What to Do When . . .

B: The Many Roles of a System Administrator

B.1 Common Positive Roles

B.2 Negative Roles

B.3 Team Roles

B.4 Summary

Exercises

Bibliography

Index