



CERT® Resilience Management Model



A Maturity
Model for
Managing
Operational
Resilience

SEI SERIES • A CERT® BOOK

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The SEI Series in Software Engineering

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CONTENTS

LIST OF FIGURES	xi
LIST OF TABLES	xiii
PREFACE	xv
ACKNOWLEDGMENTS	xxi
PART ONE—ABOUT THE CERT RESILIENCE MANAGEMENT MODEL	1
1 INTRODUCTION	7
1.1 The Influence of Process Improvement and Capability Maturity Models	8
1.2 The Evolution of CERT-RMM	10
1.3 CERT-RMM and CMMI Models	15
1.4 Why CERT-RMM Is Not a <i>Capability Maturity</i> Model	18
2 UNDERSTANDING KEY CONCEPTS IN CERT-RMM	21
2.1 Foundational Concepts	21
2.1.1 Disruption and Stress	21
2.1.2 Convergence	23
2.1.3 Managing Operational Resilience	25
2.2 Elements of Operational Resilience Management	27
2.2.1 Services	27
2.2.2 Business Processes	29

2.2.3	Assets	30
2.2.4	Resilience Requirements	33
2.2.5	Strategies for Protecting and Sustaining Assets	35
2.2.6	Life-Cycle Coverage	36
2.3	Adapting CERT-RMM Terminology and Concepts	39
3	MODEL COMPONENTS	41
3.1	The Process Areas and Their Categories	41
3.1.1	Process Area Icons	42
3.2	Process Area Component Categories	42
3.2.1	Required Components	44
3.2.2	Expected Components	44
3.2.3	Informative Components	44
3.3	Process Area Component Descriptions	44
3.3.1	Purpose Statements	44
3.3.2	Introductory Notes	44
3.3.3	Related Process Areas Section	45
3.3.4	Summary of Specific Goals and Practices	45
3.3.5	Specific Goals and Practices	45
3.3.6	Generic Goals and Practices	46
3.3.7	Typical Work Products	46
3.3.8	Subpractices, Notes, Example Blocks, Generic Practice Elaborations, References, and Amplifications	47
3.4	Numbering Scheme	47
3.5	Typographical and Structural Conventions	49
4	MODEL RELATIONSHIPS	53
4.1	The Model View	54
4.1.1	Enterprise Management	54
4.1.2	Engineering	56
4.1.3	Operations	56
4.1.4	Process Management	57
4.2	Objective Views for Assets	59
4.2.1	People	59
4.2.2	Information	59
4.2.3	Technology	60
4.2.4	Facilities	60

PART TWO—PROCESS INSTITUTIONALIZATION AND IMPROVEMENT	65
5 INSTITUTIONALIZING OPERATIONAL RESILIENCE MANAGEMENT PROCESSES	67
5.1 Overview	67
5.2 Understanding Capability Levels	68
5.3 Connecting Capability Levels to Process Institutionalization	69
5.3.1 Capability Level 0: Incomplete	70
5.3.2 Capability Level 1: Performed	70
5.3.3 Capability Level 2: Managed	70
5.3.4 Capability Level 3: Defined	72
5.3.5 Other Capability Levels	72
5.4 CERT-RMM Generic Goals and Practices	73
5.4.1 CERT-RMM Elaborated Generic Goals and Practices	74
5.5 Applying Generic Practices	74
5.6 Process Areas That Support Generic Practices	74
6 USING CERT-RMM	77
6.1 Examples of CERT-RMM Uses	78
6.1.1 Supporting Strategic and Operational Objectives	78
6.1.2 A Basis for Evaluation, Guidance, and Comparison	78
6.1.3 An Organizing Structure for Deployed Practices	79
6.1.4 Model-Based Process Improvement	80
6.2 Focusing CERT-RMM on Model-Based Process Improvement	80
6.2.1 Making the Business Case	81
6.2.2 A Process Improvement Process	82
6.3 Setting and Communicating Objectives Using CERT-RMM	83
6.3.1 Organizational Scope	85
6.3.2 Model Scope	87
6.3.3 Capability Level Targets	90
6.4 Diagnosing Based on CERT-RMM	92
6.4.1 Formal Diagnosis Using the CERT-RMM Capability Appraisal Method	92
6.4.2 Informal Diagnosis	94
6.5 Planning CERT-RMM–Based Improvements	95
6.5.1 Analyzing Gaps	95
6.5.2 Planning Practice Instantiation	95

7 CERT-RMM PERSPECTIVES	99
Using CERT-RMM in the Utility Sector, <i>by Darren Highfill and James Stevens</i>	99
Addressing Resilience as a Key Aspect of Software Assurance Throughout the Software Life Cycle, <i>by Julia Allen and Michele Moss</i>	104
Raising the Bar on Business Resilience, <i>by Nader Mehravari, PhD</i>	110
Measuring Operational Resilience Using CERT-RMM, <i>by Julia Allen and Noopur Davis</i>	115
 PART THREE—CERT-RMM PROCESS AREAS	 119
ASSET DEFINITION AND MANAGEMENT	121
ACCESS MANAGEMENT	149
COMMUNICATIONS	175
COMPLIANCE	209
CONTROLS MANAGEMENT	241
ENVIRONMENTAL CONTROL	271
ENTERPRISE FOCUS	307
EXTERNAL DEPENDENCIES MANAGEMENT	341
FINANCIAL RESOURCE MANAGEMENT	381
HUMAN RESOURCE MANAGEMENT	411
IDENTITY MANAGEMENT	447
INCIDENT MANAGEMENT AND CONTROL	473
KNOWLEDGE AND INFORMATION MANAGEMENT	513
MEASUREMENT AND ANALYSIS	551
MONITORING	577
ORGANIZATIONAL PROCESS DEFINITION	607
ORGANIZATIONAL PROCESS FOCUS	629

ORGANIZATIONAL TRAINING AND AWARENESS	653
PEOPLE MANAGEMENT	685
RISK MANAGEMENT	717
RESILIENCE REQUIREMENTS DEVELOPMENT	747
RESILIENCE REQUIREMENTS MANAGEMENT	771
RESILIENT TECHNICAL SOLUTION ENGINEERING	793
SERVICE CONTINUITY	831
TECHNOLOGY MANAGEMENT	869
VULNERABILITY ANALYSIS AND RESOLUTION	915
PART FOUR—THE APPENDICES	943
A GENERIC GOALS AND PRACTICES	945
B TARGETED IMPROVEMENT ROADMAPS	957
C GLOSSARY OF TERMS	965
D ACRONYMS AND INITIALISMS	989
E REFERENCES	993
BOOK CONTRIBUTORS	997
INDEX	1001

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PREFACE

Resilience (*noun*): the physical property of a material by which it can return to its original shape or position after deformation that does not exceed its elastic limit¹

We hear the word *resilience* everywhere these days. People are described as resilient when they bounce back from adversity. Things are described as resilient when they can withstand unusual wear and tear and still perform adequately. Organizations are described as resilient when they can meet their mission in the face of adversity and an ever-changing risk environment.

For something or somebody to be described as resilient, a few basic conditions must be met. First, a physical or logical impact must be able to be tolerated for some period of time. Second, the object or person must be able to continue its purpose or mission while impacted. And third, the object or person must be able, in some reasonable time, to return to a “normal” state.

The authors of this book have often struggled with finding the right metaphor for describing resilience. But we always seem to come back to something that everyone understands: a childhood toy called a “Slinky.”

Nearly everyone growing up either had a Slinky or knew someone who did. There wasn’t much to it—a coiled piece of wire that could do some basic tricks—but for the most part, it just kept us amused until we found something else to which to direct our attention. That is, until we tested the limits of the Slinky. Slinkys were mostly forgiving of our attempts to make them do things that weren’t intended by the designers, but there was always that one thing we did that pushed the Slinky

1. See <http://wordnet.princeton.edu>.

to its limits. And the result? The spring became a mere wire, unable to bounce back to its original shape and never again to magically crawl down the stairs on its own.

People, things, and especially organizations can be very much like Slinkys. Most organizations can manage to expand and contract as necessary to absorb the “punch” of disruption. But when the expansion is beyond sustainable limits, in either impact or duration, the organization transforms from a Slinky to a mere wire—unable to spring back to a normal operating condition. Organizations that do not operate with a conscious eye to what their Slinky looks like do so to their own peril. Consider:

- In 2007 the Economist Intelligence Unit surveyed 181 executives from around the world about business resilience. Not surprisingly, 47% of respondents said that they could endure less than *one day* of downtime from IT systems before the disruption would seriously jeopardize the survival of *the entire company* [Economist 2007].
- A National Archives and Records Administration survey cites that 25% of companies that experienced an IT outage of two to six days went bankrupt *immediately* [Economist 2007]. This same study found that 93% of companies that lost their data center for ten days or more *filed for bankruptcy within a year*.

And it isn't as though organizations don't understand the necessity of improving their operational resilience capabilities. In a 2008 Carnegie Mellon CyLab report on Enterprise Security Governance, nearly 50% of survey respondents indicated that risk and crisis oversight is important, but only 37% responded that it was a critical governance issue. Thus, board of directors members recognize the importance of operational resilience but don't feel it's important enough to do anything about (or don't know what to do to address it) [Westby 2008].

In its 2007 report *The Resilient Economy: Integrating Competitiveness and Security*, the Council on Competitiveness makes a compelling argument that the ability of an organization to actively manage resilience will become a key competitive differentiator in the twenty-first century [van Opstal 2007]. The Council's conclusions frame a business- and economics-centric argument that supports the theories we posed in 2003 about the transformation of the security discipline into one that supports a larger business-driven purpose. Clearly, today that purpose is to ensure the organization is operationally resilient and able to carry out operational risk management activities in a coordinated way, liberated from traditional silos and organizational structures.

The CERT Resilience Management Model was developed to help organizations do this and, in the end, to help them be better Slinkys.

Introducing the CERT Resilience Management Model

The CERT Resilience Management Model (CERT-RMM) is an innovative and transformative way to approach the challenge of managing operational resilience in complex, risk-evolving environments. It is the result of years of research into the ways that organizations manage the security and survivability of the assets that ensure mission success: people, information, technology, and facilities. It incorporates concepts from an established process improvement community to create a model that transcends mere practice implementation and compliance—one that can be used to mature an organization's capabilities and improve predictability and success in sustaining operations whenever disruption occurs.

The ability to manage operational resilience at a level that supports mission success is the focus of CERT-RMM. By improving its operational resilience management system—the plan, program, processes, procedures, practices, and people that are necessary to manage operational resilience—the organization in turn improves the mission assurance of high-value services. The success of high-value services in meeting their missions consistently over time and in particular under stressful conditions is vital to meeting organizational goals and objectives.

Purpose

CERT-RMM v1.1 is a capability-focused maturity model for process improvement that comprehensively reflects best practices from industry and government for managing operational resilience across the disciplines of security management, business continuity management, and IT operations management. Through CERT-RMM these best practices are integrated into a single model that provides an organization with a transformative path from a silo-driven approach for managing operational risk to one that is focused on achieving resilience management goals and supporting the organization's strategic direction.

CERT-RMM incorporates many proven concepts and approaches from the Software Engineering Institute's process improvement experience in software and systems engineering and acquisition. Foundational concepts from CMMI (Capability Maturity Model Integration) are integrated into CERT-RMM to elevate operational resilience management to a process approach and to provide an evolutionary path for improving capability. Practices in the model focus on improving the organization's management of key operational resilience processes. The effect of this improvement is realized through improving the ability of high-value services to meet their mission consistently and with high quality, particularly during times of stress.

It should be noted that CERT-RMM is not based on the CMMI Model Foundation (CMF), which is a set of model components that are common to all CMMI models and constellations. In addition, CERT-RMM does not form an additional CMMI constellation or directly intersect with existing constellations. However,

CERT-RMM makes use of several CMMI components, including core process areas and process areas from CMMI-DEV. It incorporates the Generic Goals and Practices of CMMI models, and it expands the resilience concept for services found in CMMI-SVC. Section 1.4 of this book provides a detailed explanation of the connections between CERT-RMM and the CMMI models.

Audience

The audience for CERT-RMM is anyone interested in improving the mission assurance of high-value services through improving operational resilience processes. Simply stated, CERT-RMM can help improve the ability of an organization to meet its commitments and objectives with consistency and predictability in the face of changing risk environments and potential disruptions. CERT-RMM will be useful to you if you manage a large enterprise or organizational unit, are responsible for security or business continuity activities, manage large-scale IT operations, or help others to improve their operational resilience. CERT-RMM is also useful for anyone who wants to add a process improvement dimension or who wants to make more efficient and effective use of an installed base of codes of practice, such as ISO 27000, COBIT, or ITIL.

If you are a member of an established process improvement community, particularly one centered on CMMI models, CERT-RMM can provide an opportunity to extend your process improvement knowledge to the operations phase of the asset life cycle. Thus, process improvement need not end when an asset is put into production—it can instead continue until the asset is retired.

Organization of This Book

This book is organized into three main parts:

- Part One: About the CERT Resilience Management Model
- Part Two: Process Institutionalization and Improvement
- Part Three: CERT-RMM Process Areas

Part One, About the CERT Resilience Management Model, consists of four chapters:

- Chapter 1, Introduction, provides a summary view of the advantages and influences of a process improvement approach and capability maturity models on CERT-RMM.
- Chapter 2, Understanding Key Concepts in CERT-RMM, describes all the model conventions used in CERT-RMM process areas and how they are assembled into the model.

- Chapter 3, Model Components, addresses the core operational risk and resilience management principles on which the model is constructed.
- Chapter 4, Model Relationships, describes the model in two virtual views to ease adoption and usability.

Part Two, Process Institutionalization and Improvement, focuses on the capability dimension of the model and its importance in establishing a foundation on which an operational resilience management system can be sustained in complex environments and evolving risk landscapes. The effect of increased levels of capability in managing operational resilience on the mission success of high-value services is discussed. Part Two addresses the use of the model's Generic Goals and Practices, which are sourced from CMMI and tailored for institutionalizing operational resilience management processes. Part Two also describes various approaches for using CERT-RMM, as well as considerations when applying a Plan, Do, Check, Act model for process improvement. In the last chapter of Part Two, CERT-RMM Perspectives, several invited contributing authors share their thoughts about how CERT-RMM can be applied for different purposes. Another describes how his company evaluated CERT-RMM and found it to be “a comprehensive and flexible framework” for helping to meet business resilience objectives.

Part Three, CERT-RMM Process Areas, is a detailed view of the 26 CERT-RMM process areas. They are organized alphabetically by process area acronym. Each process area contains descriptions of goals, practices, and examples.

The appendices of the book provide a detailed treatment of the model's Generic Goals and Practices, book references, a list of commonly used acronyms, and a reference glossary.

How to Use This Book

Part One of this book provides a foundational understanding of CERT-RMM, whether or not you have previous experience with process improvement models.

If you have process improvement experience, particularly using models in the CMMI family, you should start with Section 1.4 in the Introduction, which describes the relationship between CERT-RMM and CMMI models. Reviewing Part Three will provide you with a baseline understanding of the process areas covered in CERT-RMM and how they may be similar to or different from those in CMMI. Next, you should examine Part Two to understand how generic goals and practices are used in CERT-RMM. Pay particular attention to the example blocks in the generic goals and practices; they provide an illustration of how the capability dimension can be implemented in the CERT-RMM model.

If you have no process improvement experience, you should begin with the Introduction in Part One and continue sequentially through the book. The chapters are arranged to build understanding before you reach Part Three, the process areas.

Additional Information and Reader Feedback

CERT-RMM continues to evolve as more organizations use it to improve their operational resilience management processes. You can always find up-to-date information about the CERT-RMM model, including new process areas as they are developed and added, at www.cert.org/resilience. There, you can also learn how CERT-RMM is being used for critical infrastructure protection and how it forms the basis for exciting research in the area of resilience measurement and analysis.

Your suggestions for improving CERT-RMM are welcome. For information on how to provide feedback, see the CERT website at www.cert.org/resilience/request-comment. If you have comments or questions about CERT-RMM, send email to rmm-comments@cert.org.

CHAPTER 1

INTRODUCTION

The CERT Resilience Management Model (CERT-RMM) is the result of many years of research and development committed to helping organizations meet the challenge of managing operational risk and resilience in a complex world. It embodies the process management premise that “the quality of a system or product is highly influenced by the quality of the process used to develop and maintain it” by defining *quality* as the extent to which an organization controls its ability to operate in a mission-driven, complex risk environment [CMMI Product Team 2006].

CERT-RMM brings several innovative and advantageous concepts to the management of operational resilience:

- First, it seeks to holistically improve risk and resilience management through purposeful and practical convergence of the disciplines of security management, business continuity management, and aspects of IT operations management (the *convergence* advantage).
- Second, it elevates these disciplines to a process approach, which enables the application of process improvement innovations and provides a useful basis for metrics and measurement. It also provides a practical organizing and integrating framework for the vast array of practices in place in most organizations (the *process* advantage).
- Finally, it provides a foundation for process institutionalization and organizational process maturity—concepts that are important for sustaining any process but are absolutely *critical* for processes that operate in complex environments, typically during times of stress (the *maturity* advantage).

CERT-RMM v1.1 comprises 26 process areas that cover four areas of operational resilience management: Enterprise Management, Engineering, Operations, and Process Management. The practices contained in these process areas are codified from a management perspective; that is, the practices focus on the activities that an organization performs to actively *direct, control, and manage* operational resilience

in an environment of uncertainty, complexity, and risk. For example, the model does not prescribe specifically how an organization should secure information; instead, it focuses on the equally important processes of identifying high-value information assets, making decisions about the levels needed to protect and sustain these assets, implementing strategies to achieve these levels, and maintaining these levels throughout the life cycle of the assets during stable times and, more important, during times of stress. In essence, the managerial focus supports the specific actions taken to secure information by making them more effective and more efficient.

1.1 The Influence of Process Improvement and Capability Maturity Models

Throughout its history, the Software Engineering Institute (SEI) has directed its research efforts toward helping organizations to develop and maintain quality products and services, primarily in the software and systems engineering and acquisition processes. Proven success in these disciplines has expanded opportunities to extend process improvement knowledge to other areas such as the quality of service delivery (as codified in the CMMI for Services model) and to cyber security and resilience management (CERT-RMM).

The SEI's research in product and service quality reinforces three critical dimensions on which organizations typically focus: people, procedures and methods, and tools and equipment [CMMI Product Team 2006]. However, processes link these dimensions together and provide a conduit for achieving the organization's mission and goals across all organizational levels. Figure 1.1 illustrates these three critical dimensions.

Traditionally, the disciplines concerned with managing operational risk have taken a technology-centric view of improvement. That is, of the three critical dimensions, organizations often look to technology—in the form of software-based tools and hardware—to fix security problems, to enable continuity, or even to improve IT operations and service delivery. Technology can be very effective in managing risk, but technology cannot always substitute for skilled people and resources, procedures and methods that define and connect tasks and activities, and processes to provide structure and stability toward the achievement of common objectives and goals. In our experience, organizations often ask for the one or two technological advances that will keep their data secure or improve the way they handle incidents, while failing to recognize that the lack of defined processes and process management diminishes their overall capability for managing operational resilience. Most organizations are already technology-savvy when it comes to security and continuity, but the way they *manage* these disciplines is immature. In fact, incidents such as security breaches often can be traced back to poorly designed and managed processes at the enterprise and operational levels, not technology failures. Consider the following: Your organization probably has numerous

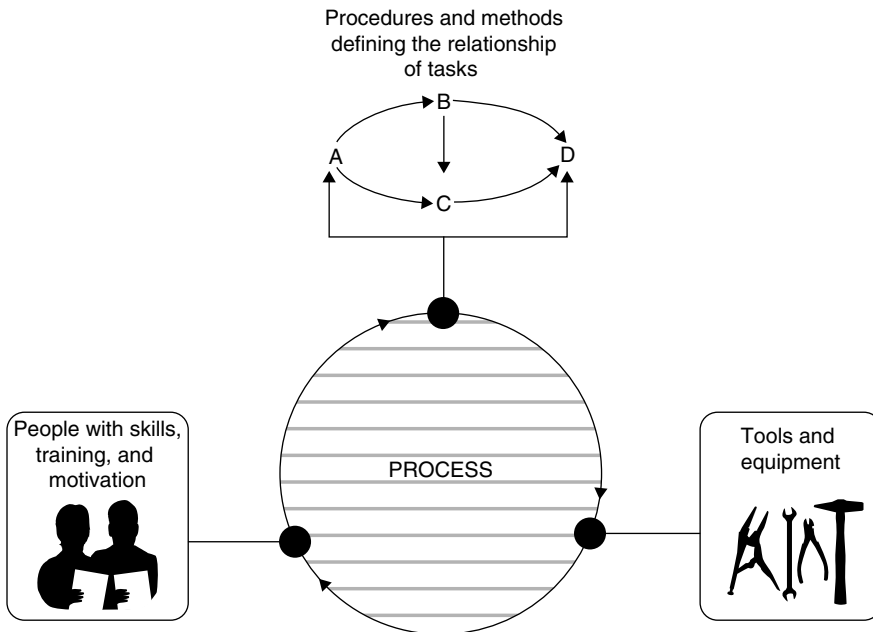


FIGURE 1.1
The Three Critical Dimensions

firewall devices deployed across its networks. But what kinds of traffic are these firewalls filtering? What rulesets are being used? Do these rulesets reflect management's resilience objectives and the needs for protecting and sustaining the assets with firewalls? Who sets and manages the rulesets? Under whose direction? All of these questions typify the need to augment technology with process so that the technology supports and enforces strategic objectives.

In addition to being technology-focused, many organizations are practice-focused. They look for a representative set of practices to solve their unique operational resilience management challenges and end up with a complex array of practices sourced from many different bodies of knowledge. The effectiveness of these practices is measured by whether they are used or "sanctioned" by an industry or satisfy a compliance requirement *instead of* by how effective they are in helping the organization reduce exposure or improve predictability in managing impact. The practices are not the problem; organizations go wrong in assuming that practices *alone* will bring about a sustainable capability for managing resilience in a complex environment.

Further damage is done by practice-based assessments or evaluations. Simply verifying the existence of a practice sourced from a body of knowledge does not

provide for an adequate characterization of the organization's ability to *sustain* that practice over the long term, particularly when the risk environment changes or when disruption occurs. This can be done only by examining the degree to which the organization embeds the practice in its culture, is able and committed to performing the practice, can control the practice and ensure that the practice is effective through measurement and analysis, and can prove the practice is performed according to established procedures and processes. In short, practices are made better by the degree to which they have been institutionalized through *processes*.

1.2 The Evolution of CERT-RMM

The CERT Resilience Management Model is the result of an evolutionary development path that incorporates concepts from other CERT tools, techniques, methods, and activities.

In 1999, CERT officially released the Operationally Critical Threat, Asset, and Vulnerability Evaluation (OCTAVE) method for information security risk management. OCTAVE provided a new way to look at information security risk from an operational perspective and asserted that business people are in the best position to identify and analyze security risk. This effectively repositioned IT's role in security risk assessment and placed the responsibility closer to the operations activity in the organization [Alberts 1999].

In October 2003, a group of 20 IT and security professionals from financial, IT, and security services, defense organizations, and the SEI met at the SEI to begin to build an executive-level community of practice for IT operations and security. The desired outcome for this Best in Class Security and Operations Roundtable (BIC-SORT) was to better capture and articulate the relevant bodies of knowledge that enable and accelerate IT operational and security process improvement. The bodies of knowledge identified included IT and information security governance, audit, risk management, IT operations, security, project management, and process management (including benchmarking), as depicted in Figure 1.2.

In Figure 1.2, the upper four capabilities (white text) include processes that provide oversight and top-level management. Governance and audit serve as enablers and accelerators. Risk management informs decisions and choices. Strategy serves as the explicit link to business drivers to ensure that value is being delivered. The lower four capabilities (black text) include processes that provide detailed management and execution in accordance with the policies, procedures, and guidelines established by higher-level management. We observed that these capabilities were all connected in high-performing IT operations and security organizations.

Workshop topics and results included defining what it means to be best in class, areas of pain and promise (potential solutions), how to use improvement frameworks

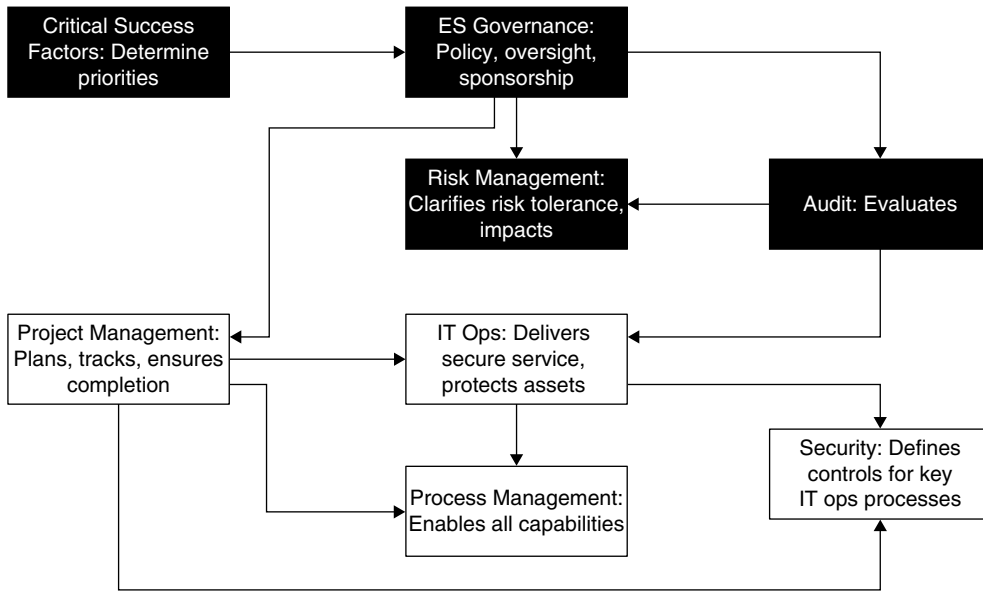


FIGURE 1.2
Bodies of Knowledge Related to Security Process Improvement

and models in this domain, the applicability of Six Sigma, and emerging frameworks for enterprise security management (precursors of CERT-RMM) [Allen 2004].

In December 2004, CERT released a technical note entitled *Managing for Enterprise Security* that described security as a process reliant on many organizational capabilities. In essence, the security challenge was characterized as a business problem owned by everyone in the organization, not just IT [Caralli 2004]. This technical note also introduced operational resilience as the objective of security activities and began to describe the convergence between security management, business continuity management, and IT operations management as essential for managing operational risk.

In March 2005, CERT hosted a meeting with representatives of the Financial Services Technology Consortium (FSTC).¹ At the time of this meeting, FSTC's Business Continuity Standing Committee was actively organizing a project to explore the development of a reference model to measure and manage operational resilience capability. Although our approaches to operational resilience had different starting points (security versus business continuity), our efforts were clearly focused on solving the same problem: How can an organization predictably and systematically control operational resilience through activities such as security and business continuity?

1. FSTC has since been incorporated into the Financial Services Roundtable (www.fsround.org).

In April 2006, CERT introduced the concept of a process improvement model for operational resilience in the technical report *Sustaining Operational Resiliency: A Process Improvement Approach to Security Management* [Caralli 2006]. This technical report defined fundamental resilience and process improvement concepts and detailed candidate focus areas (called “capability areas”) that could be included in an eventual model. This document was the foundation for developing the first instantiation of the model.

In May 2007, as a result of work with FSTC, CERT published an initial framework for managing operational resilience in the technical report *Introducing the CERT Resiliency Engineering Framework: Improving the Security and Sustainability Processes* [Caralli 2007]. In this document, the initial outline for a process improvement model for managing operational resilience was published.

In March 2008, a preview version of a process improvement model for managing operational resilience was released by CERT under the title *CERT Resiliency Engineering Framework, v0.95R* [REF Team 2008a]. This model included an articulation of 21 “capability areas” that described high-level processes and practices for managing operational resilience and, more significantly, provided an initial set of elaborated generic goals and practices that defined capability levels for each capability area.

In early 2009, the name of the model was changed to the CERT Resilience Management Model to reflect the managerial nature of the processes and to properly position the “engineering” aspects of the model. Common CMMI-related taxonomy was applied (including the use of the term *process areas*), and generic goals and practices were expanded with more specific elaborations in each process area. CERT began releasing CERT-RMM process areas individually in 2009, leading up to the “official” release of v1.0 of the model in a technical report published in 2010. The model continues to be available by process area at www.cert.org/resilience.

The publication of this book marks the official release of CERT-RMM v1.1. Version 1.1 includes minor changes to process areas resulting from field use and piloting of the model. In addition, version 1.1 introduces the concept of the *operational resilience management system*, which broadly defines the organization’s collective capability and mechanism for managing operational resilience. More about the operational resilience management system can be found in Section 2.2.

CERT-RMM

CERT-RMM draws upon and is influenced by many bodies of knowledge and models. Figure 1.3 illustrates these relationships. (See Tables 1.1 and 1.2 for details about the connections between CERT-RMM and CMMI models.)

At the descriptive level of the model, the process areas in CERT-RMM have been either developed specifically for the model or sourced from existing CMMI models and modified to be used in the context of operational resilience management. CERT-RMM also draws upon concepts and codes of practice from other security,

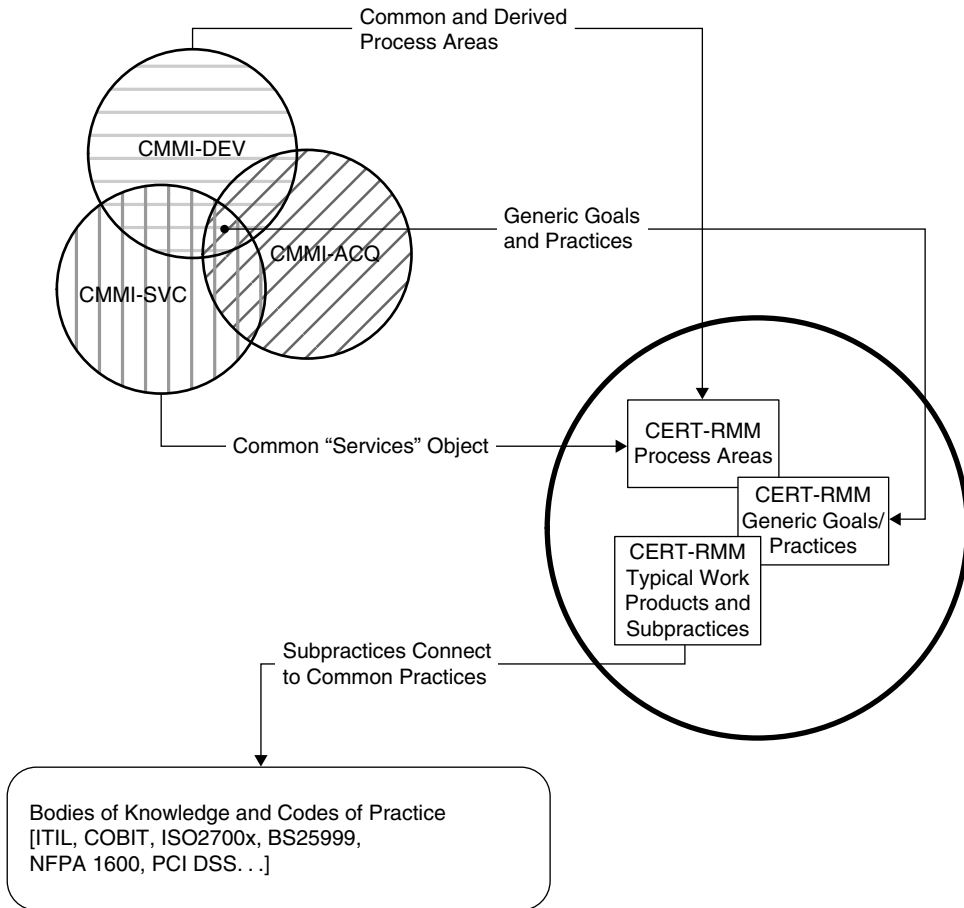


FIGURE 1.3
CERT-RMM Influences

business continuity, and IT operations models, particularly at the typical work products and subpractices level. This allows users of these codes of practice to incorporate model-based process improvement without significantly altering their installed base of practices. The *CERT Resiliency Engineering Framework: Code of Practice Crosswalk, Preview Version, v0.95R* [REF Team 2008b] details the relationships between common codes of practice and the specific practices in the CERT-RMM process areas. The Crosswalk is periodically updated to incorporate new and updated codes of practice as necessary. The Crosswalk can be found at www.cert.org/resilience.

Familiarity with common codes of practice or CMMI models is not required to comprehend or use CERT-RMM. However, familiarity with these practices and models will aid in understanding and adoption.

As a descriptive model, CERT-RMM focuses at the process description level but doesn't necessarily address how an organization would achieve the intent and purpose of the description through deployed practices. However, the subpractices contained in each CERT-RMM process area describe actions that an organization might take to implement a process, and these subpractices can be directly linked to one or more tactical practices used by the organization. Thus, the range of material in each CERT-RMM process area spans from highly descriptive processes to more prescriptive subpractices.

In terms of scope, CERT-RMM covers the activities required to establish, deliver, and manage operational resilience activities in order to ensure the resilience of services. A resilient service is one that can meet its mission whenever necessary, even under degraded circumstances. Services are broadly defined in CERT-RMM. At a simple level, a service is a helpful activity that brings about some intended result. People and technology can perform services; for example, people can deliver mail, and so can an email application. A service can also produce a tangible product.

From an organizational perspective, services can provide internal benefits (such as paying employees) or have an external focus (such as delivering newspapers). Any service in the organization that is of value to meeting the organization's mission should be made resilient.

Services rely on assets to achieve their missions. In CERT-RMM, assets are limited to people, information, technology, and facilities. A service that produces a product may also rely on raw materials, but these assets are outside of the immediate scope of CERT-RMM. However, the use of CERT-RMM in a production environment is not precluded, since people, information, technology, and facilities are a critical part of delivering a product, and their operational resilience can be managed through the practices in CERT-RMM.

CERT-RMM does not cover the activities required to establish, deliver, and manage services. In other words, CERT-RMM does not address the development of a service from requirements or the establishment of a service management system. These activities are covered in the CMMI for Services model (CMMI-SVC) [CMMI Product Team 2009]. However, to the extent that the "management" of the service requires a strong resilience consideration, CERT-RMM can be used with CMMI-SVC to extend the definition of high-quality service delivery to include resilience as an attribute of quality.

CERT-RMM contains practices that cover enterprise management, resilience engineering, operations management, process management, and other supporting processes for ensuring active management of operational resilience. The "enterprise" orientation of CERT-RMM does not mean that it is an enterprise-focused model or that it must be adopted at an enterprise level; on the contrary, CERT-RMM is focused on the operations level of the organization, where services are typically executed. Enterprise aspects of CERT-RMM describe how horizontal functions of the organization, such as managing people, training, financial resource management, and risk management, affect operations. For example, if an organization is generally poor at

risk management, the effects typically manifest at an operational level in poor risk identification, prioritization, and mitigation, misalignment with risk appetite and tolerances, and diminished service resilience.

CERT-RMM was developed to be scalable across various industries, regardless of their size. Every organization has an operational component and executes services that require a degree of operational resilience commensurate with achieving the mission. Although CERT-RMM was constructed in the financial services industry, it is already being piloted and used in other industrial sectors and government organizations, both large and small.

Finally, understanding the process improvement focus of CERT-RMM can be tricky. An example from software engineering is a useful place to start. In the CMMI for Development model (CMMI-DEV), the focus of improvement is software engineering activities performed by a “project” [CMMI Product Team 2006]. In CERT-RMM, the focus of improvement is operational resilience management activities *to achieve service resilience* as performed by an “organizational unit.” This concept can become quite recursive (but no less effective) if the “organizational unit” happens to be a unit of the organization that has primary responsibility for operational resilience management “services,” such as the information security department or a business continuity team. In this context, the operational resilience management activities are also the services of the organizational unit.

1.3 CERT-RMM and CMMI Models

CMMI v1.2 includes three integrated models: CMMI for Development, CMMI for Acquisition, and the newly released CMMI for Services. *The CMMI Framework* provides a common structure for CMMI models, training, and appraisal components. CMMI for Development and CMMI for Acquisition are early life-cycle models in that they address software and system processes through the implementation phase but do not specifically address these assets in operation. The CMMI for Services model addresses not only the development of services and a service management system but also the operational aspects of service delivery.

CERT-RMM is primarily an operations-focused model, but it reaches back into the development phase of the life cycle for assets such as software and systems to ensure consideration of early life-cycle quality requirements for protecting and sustaining these assets once they become operational. Like CMMI for Services, CERT-RMM also explicitly addresses developmental aspects of services and assets by promoting a requirements-driven, engineering-based approach to developing and implementing resilience strategies that become part of the “DNA” of these assets in an operational environment.

Because of the broad nature of CERT-RMM, emphasis on using CMMI model structural elements was prioritized over explicit consideration of integration with existing CMMI models. That is, while CERT-RMM could be seen as defining an

“operations” constellation in CMMI, this was not an early objective of CERT-RMM research and development. Instead, the architects and developers of CERT-RMM focused on the core processes for managing operational resilience, integrating CMMI model elements to the extent possible. Thus, because the model structures are similar, CMMI users will be able to easily navigate CERT-RMM.

Table 1.1 provides a summary of the process area connections between CERT-RMM and the CMMI models. Table 1.2 summarizes other CMMI model and CERT-RMM similarities. Future versions of CERT-RMM will attempt to smooth out significant differences in the models and incorporate more CMMI elements where necessary.

TABLE 1.1 Process Areas in CERT-RMM and CMMI Models

<i>CMMI Models Process Areas</i>	<i>Equivalent CERT-RMM Process Areas</i>
CAM—Capacity and Availability Management <i>(CMMI-SVC only)</i>	TM—Technology Management CERT-RMM addresses capacity management from the perspective of technology assets. It does not address the capacity of services. Availability management is a central theme of CERT-RMM, significantly expanded from CMMI-SVC. Service availability is addressed in CERT-RMM by managing the availability requirement for people, information, technology, and facilities. Thus, the process areas that drive availability management include <ul style="list-style-type: none"> • RRD—Resilience Requirements Development (where availability requirements are established) • RRM—Resilience Requirements Management (where the life cycle of availability requirements is managed) • EC—Environmental Control (where the availability requirements for facilities are implemented and managed) • KIM—Knowledge and Information Management (where the availability requirements for information are implemented and managed) • PM—People Management (where the availability requirements for people are implemented and managed) • TM—Technology Management (where the availability requirements for software, systems, and other technology assets are implemented and managed)

<i>CMMI Models Process Areas</i>	<i>Equivalent CERT-RMM Process Areas</i>
IRP—Incident Resolution and Prevention (CMMI-SVC only)	IMC—Incident Management and Control In CERT-RMM, IMC expands IRP to address a broader incident management system and incident life cycle at the asset level. Workarounds in IRP are expanded in CERT-RMM to address incident response practices.
MA—Measurement and Analysis	MA—Measurement and Analysis is carried over intact from CMMI. In CERT-RMM, MA is directly connected to MON—Monitoring, which explicitly addresses data collection that can be used for MA activities.
OPD—Organizational Process Definition	OPD—Organizational Process Definition is carried over from CMMI, but development-life-cycle–related activities and examples are deemphasized or eliminated.
OPF—Organizational Process Focus	OPF—Organizational Process Focus is carried over intact from CMMI.
OT—Organizational Training	OTA—Organizational Training and Awareness OT is expanded to include awareness activities in OTA.
REQM—Requirements Management	RRM—Resilience Requirements Management Basic elements of REQM are included in RRM, but the focus is on managing the resilience requirements for assets and services, regardless of where they are in their development cycle.
RD—Requirements Development	RRD—Resilience Requirements Development Basic elements of RD are included in RRM, but practices differ substantially.
RSKM—Risk Management	RISK—Risk Management Basic elements of RSKM are reflected in RISK, but the focus is on operational risk management activities and the enterprise risk management capabilities of the organization.
SAM—Supplier Agreement Management	EXD—External Dependencies Management In CERT-RMM, SAM is expanded to address all external dependencies, not only suppliers. EXD practices differ substantially.
SCON—Service Continuity (CMMI-SVC only)	SC—Service Continuity In CERT-RMM, SC is positioned as an operational risk management activity that addresses what is required to sustain assets and services balanced with preventive controls and strategies (as defined in CTRL).
TS—Technical Solution	RTSE—Resilient Technical Solution Engineering RTSE uses TS as the basis for conveying the consideration of resilience attributes as part of the technical solution.

TABLE 1.2 Other Connections Between CERT-RMM and the CMMI Models

<i>Element</i>	<i>Connection</i>
Generic goals and practices	<p>The generic goals and practices have been adapted mostly intact from CMMI. Slight modifications have been made as follows:</p> <ul style="list-style-type: none"> • The numbering scheme used in CERT-RMM uses GG.GP notation. For example, GG1.GP2 is generic goal 1, generic practice 2. • Generic practice 2.1 in CMMI focuses on policy, but in CERT-RMM it is expanded to address governance, with policy as an element. • Generic practice 2.6 in CMMI is “Manage Configurations,” but in CERT-RMM it is clarified to explicitly focus on “work product” configurations to avoid confusion with traditional configuration management activities as defined in IT operations.
Continuous representation	CERT-RMM adopts the continuous representation concept from CMMI intact.
Capability levels	CERT-RMM defines four capability levels up to capability level 3—“defined.” Definitions of capability levels in CMMI are carried over for CERT-RMM.
Appraisal process	The CERT-RMM capability appraisal process uses many of the elements of the SCAMPI process. The “project” concept in CMMI is implemented in CERT-RMM as an “organizational unit.” CERT-RMM capability appraisals have constructs inherited from SCAMPI. See Section 6.4.1 for the use of SCAMPI in CERT-RMM capability appraisals.

1.4 Why CERT-RMM Is Not a *Capability Maturity Model*

The development of maturity models in the security, continuity, IT operations, and resilience space is increasing dramatically. This is not surprising, since models like CMMI have proven their ability to transform the way that organizations and industries work. Unfortunately, not all maturity models contain the rigor of models like CMMI, nor do they accurately deploy many of the maturity model constructs used successfully by CMMI. It is important to have some basic knowledge about the construction of maturity models in order to understand what differentiates CERT-RMM and why the differences ultimately matter.

In its simplest form, a maturity model is an organized way to convey a path of experience, wisdom, perfection, or acculturation. The subject of a maturity model can be an object or things, ways of doing something, characteristics of something, practices, or processes. For example, a simple maturity model could define a path of

successively improved tools for doing math: using fingers, using an abacus, using an adding machine, using a slide rule, using a computer, or using a hand-held calculator. Thus, a hand-held calculator may be viewed as a more mature tool than a slide rule.

A capability maturity model (in the likeness of CMMI) is a much more complex instrument, with several distinguishing features. One of these features is that the maturity dimension in the model is a characterization of the maturity of *processes*. Thus, what is conveyed in a capability maturity model is the degree to which processes are institutionalized *and* the degree to which the organization demonstrates process maturity.

As you will learn in Chapter 5, these concepts correlate to the description of the “levels” in CMMI. For example, at the “defined” level, the characteristics of a defined process (governed, staffed with trained personnel, measured, etc.) are applied to a software or systems engineering process. Likewise for the “managed” level, where the characteristics of a managed process are applied to software or systems engineering processes. Unfortunately, many so-called maturity models that claim to be based on CMMI attempt to use CMMI maturity level descriptions yet do not have a *process* orientation.

Another feature of CMMI—as implied by its name—is that there are really two maturity dimensions in the model. The *capability dimension* describes the degree to which a process has been institutionalized. Institutionalized processes are more likely to be retained during times of stress. They apply to an individual process area, such as incident management and control. On the other hand, the *maturity dimension* is described in maturity levels, which define levels of organizational maturity that are achieved through raising the capability of a *set of process areas* in a manner prescribed by the model.

From the start, the focus in developing CERT-RMM was to describe operational resilience management from a process perspective, which would allow for the application of process improvement tools and techniques and provide a foundational platform for better and more sophisticated measurement methodologies and techniques. The ultimate goal in CERT-RMM is to ensure that operational resilience processes produce intended results (such as improved ability to manage incidents or an accurate asset inventory), and as the processes are improved, so are the results and the benefits to the organization. Because CERT-RMM is a process-focused model at its core, it was perfectly suited for the application of CMMI’s capability dimension. Thus, the model contained in this book constitutes a maturity model that has a capability dimension. However, this is not the same as a *capability maturity* model, since CERT-RMM does not yet provide an *organizational* expression of maturity. Describing organizational maturity for managing operational resilience by defining a prescriptive path through the model (i.e., by providing an order by which process areas should be addressed) requires additional study and research, and all indications from early model use, benchmarking, and piloting are that a capability maturity model for operational resilience management founded on CERT-RMM is achievable in the future.

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INDEX

A

- abuse/misuse case, 965, 976
- access acknowledgement, 965
- access control policy, 965
- access controls. *See also* Access Management (AM), 965
 - establishing identity community, 452–453
 - for information assets, 525–526
 - modification management and, 527–528
 - overview of, 150–151
 - for technology assets, 882–883
 - for trusted access. *See* Identity Management (IM)
- Access Management (AM)
 - achieve specific goals, 161
 - assign responsibility for, 165–166
 - collect improvement information, 173–174
 - correct inconsistencies, 159–160
 - defined, 965
 - enable access, 152–155
 - establish defined process for, 173
 - establish process governance, 161–162
 - FISMA compliance, 957
 - identify and involve relevant stakeholders, 168–169
 - insider threats and, 964
 - introductory notes, 149–151
 - manage and control access, 151–152
 - manage changes to access privileges, 155–157
 - manage work product configurations, 168
 - monitor and control the process, 169–171
 - monitoring needs of, 586
 - objectively evaluate adherence, 172
 - as Operations process area, 57
 - periodic review of access privileges, 157–159
 - plan the process, 163
 - provide resources for, 163–165
 - purpose, 149
 - related process areas, 151
 - review status with higher-level managers, 172
 - summary of specific goals and practices, 151
 - train people for, 167
- access privileges
 - assign on basis of identity, 451
 - correct inconsistencies in, 159–160
 - defined, 965
 - deprovisioning identity profiles and, 459–460
 - granting, 152–155
 - to human resources documents, 440–441
 - identify invalid identities, 456–457
 - identity management linked to, 449
 - manage and control access with, 151–152
 - manage changes to access, 155–157
 - manage changes to employment status, 430–431
 - manage involuntary termination, 432
 - overview of, 149–151
 - periodic review of, 157–159
- access requests
 - defined, 966
 - enabling, 152
- acculturation, 966
- achieve specific goals, generic goals and practices, 945
- acronyms, used in this book, 989–992
- acting phase, process improvement, 82–83
- action plans
 - for conflict mitigation, 755
 - implementing process action plans, 636
 - for organizational processes, 634–635
- adaptive maintenance
 - defined, 966
 - of environmental conditions, 285
- adherence, objective evaluation of
 - Access Management, 172
 - Asset Definition and Management, 144–145
 - Communications, 206
 - Compliance, 238
 - Controls Management, 267–268
 - Enterprise Focus, 336–337
 - Environmental Control, 303
 - External Dependencies Management, 377–378
 - Financial Resource Management, 408
 - generic goals and practices, 953
 - Human Resource Management, 444
 - Identity Management, 470–471
 - Incident Management and Control, 508–509
 - Knowledge and Information Management, 546
 - Measurement and Analysis, 574–575
 - Monitoring, 603
 - Organizational Process Definition, 626–627
 - Organizational Process Focus, 651
 - Organizational Training and Awareness, 682–683
 - People Management, 713
 - Resilience Requirements Development, 767
 - Resilience Requirements Management, 789–790
 - Resilient Technical Solution Engineering, 826–827
 - Risk Management, 743–744
 - Service Continuity, 864–865

- adherence, objective evaluation of (*contd.*)
 - Technology Management, 911–912
 - Vulnerability Analysis and Resolution, 939
- ADM. *See* Asset Definition and Management (ADM)
- administrative (management) controls
 - defined, 966
 - at enterprise/service/asset level, 248–250
 - for facility assets, 277–278
 - for information assets, 519–521
 - overview of, 246
 - for technology assets, 876–878
- agreements
 - confidentiality, 429–430
 - employment, 420–422
 - with external entities, 360–362, 370
 - legal, 966
 - service level agreements (SLAs), 985
- Allen, Julia H., 104–105, 115, 999, xxiii–xxiv
- AM. *See* Access Management (AM)
- amplifications, process area, 47–48
- analysis
 - of Compliance obligations, 217–218
 - of controls, 250–253
 - cost and performance analysis in budgeting, 393–394
 - measurement and. *See* Measurement and Analysis (MA)
 - of monitoring requirements, 585–587
 - of resilience requirements, 755
 - risk analysis, 983
 - root-cause analysis, 494, 984
 - of vulnerabilities. *See* Vulnerability Analysis and Resolution (VAR)
- analysis, in incident management
 - analyze and triage events, 482–483
 - to support response, 485–486
- appraisal
 - CAM (Capability Appraisal Method), CERT-RMM, 92–94
 - capability appraisal in evaluation of adherence, 953
 - capability dimension used for, 68
 - of organizational processes, 632–633
 - scope, 93–94, 966
- architecture
 - guidelines for resilient software and systems, 801–802
 - interoperability standards, 898
 - process architecture, 610, 980
- area of impact
 - business impact analysis, 892
 - defined, 966
 - limiting organizational impact of incidents, 488–490
- assembly guidelines, for Resilient Technical Solution Engineering, 805–807
- assessment
 - of awareness program, 662–663
 - of communications, 192–194
 - of controls, 253–257
 - of facility asset risks, 280–281
 - of information asset risks, 522
 - of performance, 425–426
 - of risks due to external dependencies, 350–351
 - of staff risks, 691–692
 - of technology risks, 879–880
 - of training program, 670–671
- asset custodian. *See* custodians, asset
- Asset Definition and Management (ADM)
 - achieve specific goals, 134
 - assign responsibility, 138–139
 - Cloud Computing and, 961
 - collect improvement information, 146–147
 - defined, 135, 966
 - develop resilient software across life cycle with, 107
 - as Engineering process area, 56
 - establish common understanding of assets, 126–128
 - establish defined process, 145–146
 - establish organizational assets, 123–124
 - establish ownership and custodianship, 128–130
 - establish process governance, 135–136
 - establish relationship between assets and services, 130–131
 - FISMA compliance, 958
 - identify and involve stakeholders, 141–142
 - introductory notes, 121–122
 - inventory assets, 124–126
 - manage assets, 132–134
 - manage work product configurations, 141
 - monitor and control process, 142–144
 - objectively evaluate adherence, 144–145
 - plan process, 136–137
 - provide resources, 137–138
 - purpose of, 121
 - related process areas, 122–123
 - summary of specific goals and practices, 123
 - train people for, 140
- asset disposition, 966
- asset inventory
 - creating, 124–126
 - defined, 967
 - maintaining changes to assets, 133–134
 - managing changes to employment status, 430–431
- asset life cycle, 37, 794, 967
- Asset Management, Engineering, 56
- asset owner, 967
- asset profile, 967
- Asset Resilience Management, Operations, 57
- asset-level controls, 248–250
- asset-level resilience requirements
 - analyze, 755
 - defined, 967
 - establish, 752–753
 - overview of, 748–749
 - validate, 756
- asset-level risks
 - identifying, 723–725
 - review and adjust strategies for, 732
- assets. *See also* Asset Definition and Management (ADM)
 - alternate locations for organizational process, 95–96
 - concept of, 30–33
 - define required functionality of, 754–755
 - defined, 966
 - establishing improvement objective with asset scope, 89–90
 - facility, establishing resilience-focused, 275
 - facility, prioritization of, 273–274
 - identifying vulnerabilities, 917–918
 - life-cycle, 37, 794, 967
 - managing changes to employment status, 430
 - objective views for. *See* objective views, for assets
 - operational risk as potential impact on, 25–26
 - protecting and sustaining, 35–36
 - relationships among services, business process and, 27–28
 - resilience requirements, 773–774
 - resilience requirements for, 33–35
 - risks of external entities and, 342
 - stress of managing intangible, 22
 - traceability of resilience requirements and, 777
- assets, technology
 - access controls, 882–883
 - assign resilience requirements, 875–876
 - establish and implement controls, 876–878
 - establish resilience-focused, 873–874
 - identify and assess risks, 879–880

maintain, 894–895
 manage availability of, 890–891
 manage capacity of, 895–897
 manage integrity of, 881–882
 manage interoperability of, 897–899
 manage risks, 878–879
 mitigate risks, 880–881
 perform change management, 887–888
 perform configuration management, 883–887
 perform release management, 889–890
 protect, 874–875
 sustain, 891–894
 assign responsibility, generic goals and practices, 948–949
 assurance case, 967
 Assurance for CMMI PRM (Process Reference Model), 109–110
 attack pattern, 967
 attack surface, 967
 attributes, critical attributes of process elements, 609
 audits
 for configuration management, 887
 discovery of vulnerabilities, 921
 manage external dependencies, 362
 in objective evaluation of adherence, 953
 perform resilience oversight, 324–325
 for process-compliance, 639
 review enterprise focus plan, 337
 of technology assets, 883–884
 authority, assigning
 Access Management, 165–166
 Asset Definition and Management, 138–139
 Communications, 199–200
 Compliance, 231–232
 Controls Management, 261–262
 Enterprise Focus, 330–331
 Environmental Control, 296–297
 External Dependency Management, 370–371
 Financial Resource Management, 402–403
 generic goals and practices, 949
 Human Resource Management, 437–438
 Identity Management, 464–465
 Incident Management and Control, 501–502
 Knowledge and Information Management, 539
 Measurement and Analysis, 569
 Organizational Process Definition, 621
 Organizational Process Focus, 645–646

Organizational Training and Awareness, 675
 People Management, 706–707
 Resilience Requirements Development, 760–761
 Resilience Requirements Management, 782–783
 Resilient Technical Solution Engineering, 819
 Risk Management, 738
 Service Continuity, 858
 Technology Management, 904–905
 Vulnerability Analysis and Resolution, 933
 availability
 attributes of information assets, 514
 defined, 967
 Knowledge and Information Management and, 513
 of measurement information, 564
 availability, of information assets
 document organizational and intellectual knowledge of staff, 532–533
 duplication and retention, 531–532
 overview of, 530–531
 availability, of staff
 establish redundancy for vital staff, 694–695
 manage, 693–694
 perform succession planning, 695–697
 plan for return-to-work following disruptive events, 700–701
 plan to support staff during disruptive events, 698–700
 prepare for redeployment, 697–698
 availability, of technology assets
 maintain technology assets, 894–895
 manage technology capacity, 895–897
 manage technology interoperability, 897–899
 overview of, 890–891
 sustain technology assets, 891–894
 awareness activity, 967
 awareness materials, 659–660
 awareness plan, 657–658
 awareness program. *See also* Organizational Training and Awareness (OTA)
 assess effectiveness of, 662–663
 defined, 967
 establish delivery capability, 658–660
 establish needs, 655–657
 establish plan, 657–658
 overview of, 655
 perform activities, 660–661

records of, 661–662
 waiver. *See* waiver

B

back up, of information assets, 531–532
 base measures
 data collection and, 561–562
 defined, 967
 specify, 556
 baseline competencies
 comparing skills inventory to, 416
 establishment of, 414–415
 baseline verification criteria, acquisition of staff, 419
 baselines
 baseline configuration item, 968
 for change management, 887–888
 for configuration management, 887
 identifying and assessing risks, 522
 resilience requirements, 776
 for technology assets, 884
 BES (Bulk Electric System), 101–102
 BIC-SORT (Best in Class Security and Operations Roundtable), 10–11
 BRM (business resilience management), 110–115
 budgeting
 benefits of CERT-RMM, 6
 commit funds for operational resilience management, 383–384
 establish financial commitment, 382–383
 establish resilience budgets, 388–389
 establish structure to support financial management, 384–386
 fund resilience activities, 390–391
 perform cost and performance analysis, 393–394
 resolve funding gaps, 388–389
 bugs, availability of technology assets and, 891
 builds, release management and, 889–890
 Bulk Electric System (BES), 101–102
 business case
 for adoption of CERT-RMM processes, 81
 commit funds for operational resilience management, 383–384
 for convergence of operational risk activities, 24–25
 fund operational resilience management, 318–319

business continuity plans. *See also*
 service continuity plans, 839
 business impact analysis, availability
 of technology assets and, 892
 business processes
 concept of, 29–30
 defined, 968
 fueled by assets, 30–33
 relationships among services, assets
 and, 27–28
 business requirements. *See also*
 resilience requirements, 968
 business resilience, downtime
 tolerance and, xvi
 business resilience management
 (BRM), 110–115

C

CAM (Capability Appraisal Method),
 CERT-RMM, 92–94
 capability appraisal, in objective
 evaluation of adherence, 953
 Capability Appraisal Method (CAM),
 CERT-RMM, 92–94
 capability dimension, CERT-RMM
 defined, 68
 understanding capability levels,
 68–69
 capability dimension, CMMI, 19
 capability levels
 connecting to process
 institutionalization, 69–73
 considerations when establishing
 targets, 84–85
 defined, 968
 for generic goals and practices, 73
 overlaying ratings on targeted
 improvement profile, 93–94
 targeted improvement profile,
 91–92
 targets for establishing
 improvement objectives,
 90–91
 understanding, 68–69
 Capability Maturity Model Integration.
See CMMI (Capability Maturity
 Model Integration)
 capacity, of technology assets, 895–897
 capacity planning, 896, 968
 Caralli, Richard A., 1000, xxiii
 catalogs
 of external dependencies, 344–347
 of items in process asset library, 614
 categories
 of information assets, 517–518, 975
 process areas by, 41–42
 of process components, 42–44
 of risk, 351, 719–720, 727
 CERT Resiliency Engineering
 Framework: Code of Practices

Crosswalk, Preview Version,
 v0.95R (REF Team 2008b), 13
 CERT Resiliency Engineering
 Framework, v0.95R (REF Team
 2008a), 12
 certification training,
 Communications, 201
 CERT-RMM (CERT Resilience
 Management Model)
 audience for, xviii
 benefits to organizations, 5–6
 CMMI models and, 15–18
 CMMI vs., 18–19
 evolution of, 9–12
 influences on, 12–15
 introduction to, xvii
 need for, 3–4
 official release of v1.1, 12
 overview of, 7–8
 process improvement and CMMI
 models influencing, 8–9
 as process improvement
 model, 2–3
 purpose of, xvii–xviii
 CERT-RMM concepts
 adapting terminology and, 39
 convergence, 23–25
 disruption and stress, 21–23
 elements of operational resilience
 management, 27–39
 operational resilience management,
 25–27
 CERT-RMM uses
 for business resilience, 110–115
 diagnosing with, 92–95
 examples, 78–80
 measuring operational resilience,
 115–118
 model-based process improvement
 with, 80–83
 overview of, 77
 planning improvements with, 95–97
 setting and communicating
 objectives. *See* objectives,
 setting and communicating
 for software assurance, 104–110
 for utility sector, 99–104
 change criteria
 for asset management, 132–133
 for service continuity tests, 852
 change management
 for configuration settings, 887
 defined, 968
 for external dependencies, 362
 for identity community, 455–456
 for resilience requirements,
 775–776
 for service continuity tests, 852–853
 for technology assets, 887–888
 for work product configurations,
 950

channels, communications
 establish and maintain
 infrastructure for, 190–191
 identify, 188–190
 checks, integrity, 562
 classes, formal capability appraisal,
 92–94
 closing incidents, 492–493
 Cloud Computing, targeted
 improvement roadmap for,
 961–963
 CMMI (Capability Maturity Model
 Integration)
 CERT-RMM generic goals and
 practices vs., 73
 equivalent CERT-RMM process
 areas, 15–18
 evolution of CERT-RMM and,
 12–15
 process areas influencing CERT-
 RMM RTSE, 108, 795
 using CERT-RMM without
 familiarity with, 13
 why CERT-RMM is not, 18–19
 CMMI-ACQ (CMMI for Acquisition)
 model
 defined, 15
 equivalent CERT-RMM process
 areas, 17–18
 influencing CERT-RMM, 13
 CMMI-DEV (CMMI for Development)
 model
 defined, 15
 equivalent CERT-RMM process
 areas, 17–18
 focus of process improvement in, 15
 influencing CERT-RMM, 13
 CMMI-SVC (CMMI for Services)
 model
 defined, 15
 equivalent CERT-RMM process
 areas, 16–18
 influencing CERT-RMM, 13
 codes of practice
 convergence vs., 25
 relationship between CERT-RMM
 process areas and other, 12–13
 coding guidelines, for resilient
 software and systems, 803
 collect improvement information. *See*
 improvement information,
 collecting
 co-location, 968
 commitment
 establish financial commitment,
 382–383
 of funds to operational resilience
 management, 383–384
 to incident management plan, 477
 to resilience requirements, 774–775
 to service continuity plans, 834–835

- communication
 - of awareness activities, 660
 - of changes to resilience requirements, 776
 - guidelines and standards, 181–183
 - identify relevant stakeholders, 177–179
 - identify requirements for, 179–181
 - in incident management, 490–492
 - in incident response and recovery, 487–488
 - measure and assess performance using, 425–426
 - of measurement results, 564–565
 - of measures, 557
 - of objectives. *See* objectives, setting and communicating
 - preparing for, 177
 - process lessons learned and, 639–640
 - to stakeholders, 951
 - to stakeholders regarding incidents, 489
 - of vulnerability analysis and resolution strategy, 919
- communication program
 - assessing effectiveness of, 192–194
 - assigning staff to, 186–188
 - establishing, 185–186
 - improving, 194–195
- Communications (COMM)
 - achieve specific goals, 195
 - assign responsibility for, 199–200
 - collect improvement information, 207–208
 - defined, 968
 - deliver, 188–191
 - Enterprise Management, 54–55
 - establish and maintain plan for, 197–198
 - establish defined process, 207
 - establish guidelines and standards, 181–183
 - establish plan, 183–184
 - establish process governance, 196–197
 - establish program, 185–186
 - identify and assign plan staff, 186–188
 - identify and involve relevant stakeholders, 202–203
 - identify relevant stakeholders, 177–179
 - identify requirements, 179–181
 - improve, 191–195
 - introductory notes, 175–176
 - manage work product configurations, 202
 - monitor and control the process, 203–205
 - objectively evaluate adherence, 206
 - plan the process, 197–198
 - prepare for, 177
 - prepare for management of, 183
 - provide resources for, 198–199
 - purpose of, 175
 - related process areas, 176
 - relationships driving threat/incident management, 58
 - review status with higher-level managers, 206
 - summary of specific goals and practices, 176
 - train people for, 200–201
- communications stakeholders, 968
- comparison, using CERT-RMM as basis for, 78–79
- compensating controls, 247
- competitive differentiators, resilience management as, xvi
- complexity, operational risk of, 22
- compliance
 - collection and preservation of evidence and, 482
 - converting compliance activities into improvement activities, 6
 - defined, 968
 - developing program for, 212–214
 - evaluating adherence to. *See* adherence, objective evaluation of
 - performing resilience oversight, 324
- Compliance (COMP)
 - achieve specific goals, 227
 - analyze obligations for, 217–218
 - assign responsibility for, 231–232
 - collect and validate compliance data, 219–225
 - collect improvement information, 239–240
 - defined, 968
 - demonstrate extent of satisfaction of obligations, 221–223
 - establish defined process, 239
 - establish guidelines and standards, 214
 - establish obligations for, 215–217
 - establish ownership for meeting obligations, 218–219
 - establish plan for, 211–212
 - establish process governance, 227–228
 - establish program for, 212–214
 - identify and involve relevant stakeholders, 234–236
 - introductory notes, 209–210
 - manage work product configurations, 234
 - monitor activities of, 225–226
 - monitor and control the process, 236–237
 - objectively evaluate adherence, 238
 - plan the process, 229
 - prepare for compliance management, 210–211
 - provide resources for, 229–231
 - purpose of, 209
 - related process areas, 210
 - remediate areas of non-compliance, 223–225
 - review status with higher-level managers, 238
 - summary of specific goals and practices, 210
 - train people for, 232–233
- compliance knowledgebase, 969
- compliance obligations, 969
- compliance office, defining and installing, 212
- components, model
 - defined, 981
 - expected components, 43–44, 48, 972
 - informative component, 43–44, 48, 975
 - numbering scheme, 47–49
 - process area component categories, 42–44
 - process area component descriptions, 44–47
 - process areas and their categories, 41–42
 - required components, 43–44, 48, 981
 - typographical and structural conventions, 49–51
- computer security incident response team (CSIRT), 476
- conditions, 969
- confidentiality
 - access controls and, 525–526
 - agreements, 429–430
 - attributes of information assets, 514
 - defined, 969
 - disposal management, 526–527
 - encrypt high-value information, 524–525
 - Knowledge and Information Management process area and, 513
 - of measurement information, 564
 - overview of, 523–524
- configuration items, 969
- configuration management
 - defined, 969
 - for information assets, 529
 - for technology assets, 883–887
 - work product configurations and, 950
- conflict resolution
 - identify and resolve conflicts in service continuity plans, 846
 - mitigation action plans, 755

consistency vs. flexibility, 611
 constellation, 969
 containers
 defined, 969
 managing information asset risk
 in, 521
 contingency plans. *See* service continuity plans
 continuity of operations. *See also* Service Continuity (SC), 969
 continuous representation, of CERT-RMM structure, 68–69
 contracts, with external entities, 360–362
 control objectives
 analysis of controls to ensure, 250–252
 assessment process for, 255–257
 defining, 244–246
 establishing controls to meet, 246–248
 identifying and establishing controls, 248–250
 overview of, 244
 controls. *See also* monitor and control access. *See* access controls
 administrative. *See* administrative (management) controls
 defined, 969–970
 external dependencies management, 361
 for incident management, 506–508
 for information assets, 519–521
 internal, 975
 manage work product
 configurations and, 950
 revision plan, 732
 for risk mitigation, 732
 for technology assets, 875–878
 for validity and reliability of information assets, 529–530
 Controls Management (CTRL)
 achieve specific goals, 257
 analyze controls, 250–253
 assess control effectiveness, 253–257
 assign responsibility for, 261–262
 collect improvement information, 269–270
 define controls, 248–250
 defined, 970
 as Engineering process area, 56
 establish control objectives, 244–246
 establish controls supporting objectives, 246–248
 establish defined process for, 269
 establish process governance, 257–259
 FISMA compliance, 959

identify and involve relevant stakeholders, 264–265
 insider threats and, 964
 introductory notes, 241–243
 manage work product
 configurations, 264
 managing changes to protecting and sustaining services and assets, 131
 managing overall internal control system in, 151
 monitor and control process, 265–267
 objectively evaluate adherence, 267–268
 plan process, 259
 provide resources, 259–261
 purpose of, 241
 related process areas, 243
 relationships driving threat/incident management, 58
 review status with higher-level managers, 268
 summary of specific goals and practices, 244
 train people for, 262–263
 convergence
 defined, 970
 of operational risk management activities, 23–25
 convergence advantage
 of CERT-RMM, 5–6
 defined, 7
 coordination communications, 187
 corrective measures
 for access privileges, 159–160
 for controls management, 247
 defined, 970
 for enterprise focus, 325–326, 336–337
 for environmental conditions, 285
 for inconsistencies in identity community, 457–459
 monitoring and controlling and, 952–953
 for performance issues, 325–326
 cost of resilience, 970
 costs. *See also* Financial Resource Management (FRM)
 external dependencies management, 362
 of non-compliance, 222–223
 used to track and document resilience management, 392–393
 credentialing, 970
 crisis
 defined, 970
 governance, xvi
 critical success factors, 970

cross-training, 970
 The Crosswalk, 13
 cryptography. *See* encryption
 CSIRT (computer security incident response team), 476
 CTRL. *See* Controls Management (CTRL)
 cultural norms, stress of managing globalization risks, 23
 curriculum, for training program, 668
 custodians
 of access management, 159–160, 168–169
 of asset definition and management, 126–130
 defining, 33
 of environmental control, 296–297
 custodians, asset
 conformity to resilience requirements, 778
 defined, 966
 resilience requirements and, 774–775

D

damage control, responding to incidents, 489
 dashboard, governance, 324
 data analysis. *See also* Measurement and Analysis (MA)
 of measurement data, 562–563
 methods and tools, 559–560
 data collection
 collection standards and guidelines, 589–591
 of compliance data, 219–221
 of measurement data, 561–562
 monitoring and, 577–579, 588–589
 of monitoring data, 591–592
 techniques for, 557–559
 vulnerability data collection, 921–922
 Data Collection and Logging, Process Management, 58–59
 data storage, 563–564
 databases
 for change management, 888
 for configuration management, 886
 identify external dependencies, 344–347
 identify vital organizational, 837–839
 incident knowledgebase, 922
 of service continuity plans, 843
 Davis, Noopur, 115
 defined process
 Access Management, 173
 Asset Definition and Management, 145–146

- Communications, 207
- Compliance, 239
- Controls Management, 269
- defined, 970
- Enterprise Focus, 337–338
- Environmental Control, 304
- External Dependencies
 - Management, 378–379
- Financial Resource Management, 409
- generic goals and practices, 954
- Human Resource Management, 445
- Identity Management, 471
- Incident Management and Control, 510
- Knowledge and Information
 - Management, 547–548
- Measurement and Analysis, 575–576
- Monitoring, 604
- Organizational Process Definition, 627–628
- Organizational Process Focus, 652
- Organizational Training and
 - Awareness, 683
- overview of, 72
- People Management, 714
- Resilience Requirements
 - Development, 768–769
- Resilience Requirements
 - Management, 791
- Resilient Technical Solution
 - Engineering, 827–828
- Risk Management, 744–745
- Service Continuity, 865–866
- Technology Management, 912–913
- Vulnerability Analysis and
 - Resolution, 940
- deliver communications
 - establish and maintain
 - infrastructure, 190–191
 - identify methods and channels, 188–190
 - overview of, 188
- delivery capability
 - for awareness program, 658–660
 - for training program, 666–668
- Deming, Edward, 80, 82
- dependencies
 - analyze asset-service, 131
 - identify, 837
 - manage external. *See* External Dependencies Management (EXD)
 - manage on public infrastructure for facilities, 288–289
 - manage on public services for facilities, 287
- deploy practices, using CERT-RMM as
 - organizing structure for, 79–80
- deploy process assets
 - incorporate experiences into
 - process assets, 639–641
 - monitoring implementation, 639
 - overview of, 636–637
 - standard processes, 638
- deprovisioning identities
 - controlling identity management
 - work products, 466–467
 - correcting inconsistencies in
 - identity community, 458–459
 - defined, 970
 - introduction to, 448–449
 - involving stakeholders in, 468
 - overview of, 459–460
- derived measures
 - data collection and, 561–562
 - data sets for, 563
 - defined, 971
 - specifying, 556
- descriptive statistics, in data analysis, 560
- design guidelines, for resilient software
 - and systems, 801–802
- detective controls, 247–248
- development lifecycle, software and
 - systems, 793
- development plans, for resilient
 - technical solutions
 - creating, 807–808
 - integrating selected guidelines with, 809–810
 - monitor execution of, 810–812
 - release solutions into production, 812–813
 - select and tailor guidelines for, 808–809
- diagnosing phase, process
 - improvement
 - defined, 82–83
 - formal diagnosis using Capability Appraisal Method, 92–94
 - informal diagnosis, 94–95
 - planning CERT-RMM-based
 - improvements, 95–97
- diagnosis of current resilience
 - practices
 - formal, using Capability Appraisal Method, 92–94
 - informal, 94–95
- digital information, stress of managing
 - intangible assets, 22
- disciplinary action, for violation of
 - resilience policies, 426–427
- disposition (disposal)
 - defined, 971
 - of information assets, 526–527
- dispute resolution, external
 - dependencies management, 362
- disruptive events
 - CERT-RMM control of
 - organizational behavior
 - during, 21–23
 - identifying staff risks, 691
 - managing staff availability during, 693
 - plan for return-to-work following, 700–701
 - plan to support staff during, 698–700
 - prepare for redeployment of staff
 - during, 697–698
 - distribution, of monitoring
 - information, 592–594
 - DNA, identity's
 - defined, 450
 - understanding, 447–448
 - documentation
 - in access management, 173–174
 - in asset definition and management, 146–147
 - of awareness needs, 657
 - of changes to process assets, 637
 - of changes to resilience
 - requirements, 776
 - of commitments to resilience
 - requirements, 774–775
 - of commitments to service
 - continuity plans, 834
 - of communications, 194, 197, 207–208
 - of compliance, 223, 239–240
 - of controls management, 245–246, 269–270
 - of disciplinary action, 426–427
 - of environmental controls, 277, 286–290, 305
 - event detection and, 479
 - of external dependencies
 - management, 361
 - in financial resource management, 388, 392–394, 400
 - in human resource management, 419, 422, 435–436
 - in identity management, 450–451, 458–459, 462–463
 - of improvement information, 955
 - of incident analysis, 486
 - of incident evidence, 481–482
 - incident management plan and, 476
 - of inconsistencies in resilience
 - requirements, 778
 - of maintenance operations, 895
 - of measurement objectives, 555
 - post-incident review and, 494
 - of return-to-work plan, 700
 - of risk measurement criteria, 723
 - of scope of vulnerabilities, 917
 - of service continuity plans, 840–842

documentation (*contd.*)
 of service continuity tests, 848
 of succession plan, 696
 of support for staff during disruptive events, 699
 of training needs, 665
 of vulnerability analysis and resolution strategy, 919
 downtime
 business resilience and, xvi
 planned, 890, 979
 unplanned, 890, 987
 due diligence, performing on candidate external entities, 359
 duplication, of information assets, 531–532

E

EC. *See* Environmental Control (EC)
 EF. *See* Enterprise Focus (EF)
 emergency actions, responding to incidents, 489
 employment. *See* Human Resource Management (HRM)
 employment agreements, 420–422
 employment status, managing changes to
 manage access to assets, 430–431
 manage impact of position changes, 428–430
 manage involuntary terminations, 431–432
 overview of, 427–428
 encryption
 cryptographic controls, 970
 of high-value information, 524–525
 policies, 971
 Engineering process areas
 ADM. *See* Asset Definition and Management (ADM)
 CTRL. *See* Controls Management (CTRL)
 defined, 7–8
 model view of, 56
 overview of, 41–43
 RRD. *See* Resilience Requirements Development (RRD)
 RRM. *See* Resilience Requirements Management (RRM)
 RTSE. *See* Resilient Technical Solution Engineering (RTSE)
 SC. *See* Service Continuity (SC)
 Enterprise Focus (EF)
 achieve specific goals, 325–326
 assign responsibility for, 330–331
 collect improvement information, 338–339
 commit funding for operational resilience management, 318–319
 defined, 971
 as Engineering process area, 56
 establish corrective actions, 325–326
 establish critical success factors, 310–312
 establish defined process, 337–338
 establish organizational services, 312–314
 establish process governance, 327–328
 establish resilience as governance focus area, 322–323
 establish sponsorship, 317
 establish strategic objectives, 309–310
 FISMA compliance, 958
 identify and involve relevant stakeholders, 332–333
 identify communications requirements with, 180
 introductory notes, 307–308
 manage work product configurations, 332
 monitor and control the process, 333–336
 objectively evaluate adherence, 336–337
 perform resilience oversight, 324–325
 plan for operational resilience, 314–317
 plan the process, 328–330
 promoting resilience-aware culture, 319–320
 provide resilience oversight, 321–322
 provide resources for, 328–329
 purpose of, 307
 related process areas, 308
 relationships driving threat/incident management, 58
 review status with higher-level managers, 337
 summary of specific goals and practices, 308
 train people for, 331
 enterprise level
 monitoring at, 579
 policies, 971
 specifications for external entities, 353–354
 enterprise management, aspects of
 CERT-RMM, 14–15
 Enterprise Management process areas
 COMM. *See* Communications (COMM)
 COMP. *See* Compliance (COMP)
 defined, 7–8
 EF. *See* Enterprise Focus (EF)
 FRM. *See* Financial Resource Management (FRM)
 HRM. *See* Human Resource Management (HRM)
 model view of, 54–55
 OTA. *See* Organizational Training and Awareness (OTA)
 overview of, 41–43
 RISK. *See* Risk Management (RISK)
 enterprise-level controls
 as administrative controls, 246
 assessing effectiveness of, 253–254
 creating, 248–250
 defined, 242
 enterprise-level resilience requirements
 assigning to services, 753–754
 defined, 971
 establishing, 751–752
 identifying, 750
 overview of, 748
 entities, creating identities for. *See* Identity Management (IM)
 Environmental Control (EC)
 achieve specific goals, 290
 assign resilience requirements to facility assets, 276–277
 assign responsibility for, 296–297
 Cloud Computing and, 963
 collect improvement information, 304–305
 control operational environments, 282–283
 defined, 971
 establish and implement controls, 277–280
 establish defined process, 304
 establish process governance, 290–292
 establish resilience-focused facility assets, 275
 FISMA compliance, 958
 identify and involve relevant stakeholders, 299–300
 introductory notes, 271–272
 maintain environmental conditions, 285–286
 manage dependencies on public infrastructure, 288–289
 manage dependencies on public services, 287
 manage facility asset risk, 280–282
 manage work product configurations, 298–299
 monitor and control the process, 300–302
 monitor needs of, 586
 objectively evaluate adherence, 303
 as Operations process area, 57
 perform facility sustainability planning, 284–285
 plan for facility retirement, 289–290
 plan the process, 292–293
 prioritize facility assets, 273–274

protect facility assets, 275–276
 provide resources for, 293–295
 purpose of, 271
 related process areas, 272
 review status with higher-level managers, 303
 summary of specific goals and practices, 272
 train people for, 297–298
 environments. *See* operational environments
 equipment
 as critical dimension of organizations, 8–9
 service intervals in maintaining, 894–895
 errors, availability of technology assets and, 891
 escalation. *See* incident escalation
 escrow provisions, external dependencies management, 362
 establish and maintain, defined, 971
 establish defined process. *See* defined process
 establish process governance. *See* governance
 Establishing and Managing Resilience, Engineering, 56
 establishing phase, process improvement, 82–83
 evaluation
 of external entities, 358–359
 form for assessing training effectiveness, 670
 using CERT-RMM as basis for, 78–79
 event detection
 analyzing and triaging events, 482–483
 collecting, documenting, and preserving event evidence, 481–482
 establishing process for, 478
 logging and tracking events, 480–481
 monitoring, identifying, and reporting events, 478–479
 transitioning from detection to declaration, 484
 event logging, in incident management, 480–481
 event triage
 defined, 971
 overview of, 482
 events
 defined, 971
 disruptive. *See* disruptive events
 evidence collection, responding to incidents, 489
 example blocks, process area defined, 47–48
 typographical and structural conventions, 51

EXD. *See* External Dependencies Management (EXD)
 exercises. *See also* test (exercise)
 service continuity plans, 971
 exit interview process, 429
 expected components
 defined, 972
 overview of, 43–44
 summary of, 48
 expenditures, optimizing resilience
 determine return on investments, 396–397
 identify cost recovery opportunities, 397–398
 overview of, 394–396
 expense requests, funding resilience activities, 391
 experience, incorporating into process assets, 639–641
 external dependencies, 972
 External Dependencies Management (EXD)
 achieve specific goals, 365
 assign responsibility for, 370–371
 Cloud Computing and, 962
 collect improvement information, 379–380
 defined, 972
 develop resilient software across life cycle with, 108
 establish defined process, 378–379
 establish enterprise specifications for, 353–354
 establish formal relationships, 352–353
 establish process governance, 366–367
 establish resilience specifications for, 355–357
 evaluate and select external entities, 358–359
 formalize relationships, 360–362
 identify and involve relevant stakeholders, 373–374
 identify external dependencies, 344–347
 identify risks associated with external dependencies, 349–351
 introductory notes, 341–343
 manage external entity performance, 363–365
 manage work product configurations, 373
 monitor and control the process, 375–377
 objectively evaluate adherence, 377–378
 as Operations process area, 57
 plan the process, 368
 prioritize external dependencies, 348–349

provide resources for, 368–370
 purpose of, 341
 related process areas, 343
 review status with higher-level managers, 378
 risk mitigation strategies for external dependencies, 352
 summary of specific goals and practices, 344
 train people for, 371–372
 external entities, 972
 external sources, of vulnerabilities, 920

F

facilities. *See also* Asset Definition and Management (ADM) and Environmental Control (EC)
 facility assets. *See also* Asset Definition and Management (ADM)
 access privileges focusing on, 153
 achieve specific goals, 290
 assign resilience requirements to, 276–277
 assign responsibility for, 296–297
 in CERT-RMM, 32
 collect improvement information, 304–305
 controlling operational environment, 282–283
 defined, 972
 establish and implement controls for, 277–280
 establish process governance for, 290–292
 establish resilience-focused, 33–35, 275
 identify and assess risk for, 280–281
 identify and involve relevant stakeholders, 299–300
 life-cycle of, 38
 manage work product configurations, 298–299
 managing dependencies on public infrastructure for, 288–289
 managing dependencies on public services for, 287
 monitor and control, 300–302
 objective views for, 60–61, 63–64
 perform sustainability planning, 284–285
 plan for retirement of, 289–290
 plan process for, 292–293
 prioritization of, 273–274
 protect, 35–36, 275–276
 provide resources for, 293–295
 review status with higher-level managers, 304
 risk mitigation strategies for, 281–282
 train people, 297–298

Federal Energy Regulatory Commission (FERC), 101–102

federations

- correcting inconsistencies in identity community, 458
- defined, 447, 972
- of identities, 468

FERC (Federal Energy Regulatory Commission), 101–102

financial commitment, establishing

- establish structure to support, 384–386
- for operational resilience management, 383–384
- overview of, 382–383

financial exceptions, in cost and performance analysis, 394

Financial Resource Management (FRM)

- account for resilience activities, 392–394
- achieve specific goals, 398
- assign responsibility for, 402–403
- collect improvement information, 410
- commit funding for operational resilience management, 383–384
- defined, 972
- Enterprise Management and, 54–55
- establish defined process, 409
- establish financial commitment, 382–383
- establish process governance, 398–400
- establish structure to support financial management, 384–386
- fund resilience activities, 390–391
- identify and involve relevant stakeholders, 404–406
- introductory notes, 381–382
- manage work product configurations, 404
- monitor and control the process, 406–407
- objectively evaluate adherence, 408
- optimize resilience expenditures and investments, 394–398
- perform financial planning, 386–390
- plan the process, 400
- provide resources for, 400–402
- purpose of, 391
- related process areas, 382
- review status with higher-level managers, 409
- summary of specific goals and practices, 382
- train people for, 403–404

Financial Services Technology Consortium (FTSC), 11

first responders, 972

FISMA compliance, 957–961

flexibility vs. consistency, 611

formal agreements, with external entities

- assigning responsibility, 370
- overview of, 360–362

formal relationships, with external entities

- establish enterprise specifications, 353–354
- establish formal agreements, 360–362
- establish resilience specifications, 355–357
- evaluate and select external entities, 358–359
- overview of, 352–353

FRM. *See* Financial Resource Management (FRM)

FTSC (Financial Services Technology Consortium), 11

functional monitoring requirements, 972

funding. *See also* Financial Resource Management (FRM)

- establishing baseline competencies to determine, 414
- operational resilience management, 316–319
- resource provision and, 948

funding, for process areas

- Access Management, 164
- Asset Definition and Management, 138
- Communications, 199
- Compliance, 213, 230
- Controls Management, 260
- Enterprise Focus, 329
- Environmental Control, 294
- External Dependency Management, 369
- Human Resource Management, 437
- Identity Management, 463
- Incident Management and Control, 500
- Knowledge and Information Management, 538
- Measurement and Analysis, 568
- Monitoring, 597
- Organizational Process Definition, 620
- Organizational Process Definition and, 618
- Organizational Process Focus, 644
- Organizational Training and Awareness, 675
- People Management, 705
- Resilience Requirements Development, 760

Resilience Requirements Management, 782

Resilient Technical Solution Engineering, 817

Risk Management, 737

Service Continuity, 856

Technology Management, 903

Vulnerability Analysis and Resolution, 932

fuzz testing, 972

G

general guidelines, for Resilient Technical Solution Engineering, 798–800

generic goals and practices

- applying, 74
- assign responsibility, 948–949
- capability levels related to, 69–73
- collect improvement information, 955
- defined, 46–48, 972–973
- elaborations, 74
- establish defined process, 954
- establish process governance, 946
- identify and involve relevant stakeholders, 951
- manage work product configurations, 950
- monitor and control the process, 951–953
- objectively evaluate adherence, 953
- perform specific practices, 945
- plan the process, 946–947
- process areas supporting, 74–75
- provide resources, 948
- review status with higher-level managers, 953
- tags and numbering scheme for, 49
- train people, 949–950
- typographical and structural conventions, 50
- understanding, 73
- using practice-level scope, 88–89

geographical controls

- establishing and managing. *See* Environmental Control (EC)
- for operational environment, 283

geographical dispersion, 973

geopolitical shifts, stress of managing globalization risks, 23

global economy, stress of managing operational risk in, 22–23

globalization, operational resilience management and, 2

goals. *See also* objectives

- establishing resilience through goals and objectives, 423–424
- generic. *See* generic goals and practices

measure performance against goals and objectives, 425–426

governance, process

- Access Management, 161–162
- Asset Definition and Management, 135–136
- Communications, 196–197
- Compliance, 212, 227–228
- Controls Management, 241, 257–259

defined, 973

- Enterprise Focus, 327–328
- Environmental Control, 290–292

establish corrective actions, 325–326

establish resilience as focus area of, 322–323

- External Dependencies Management, 366–367
- Financial Resource Management, 398–400
- generic goals and practices, 946
- Human Resource Management, 433–435
- Identity Management, 460–462
- Incident Management and Control, 497–498
- Knowledge and Information Management, 534–536
- Measurement and Analysis, 566–567
- Monitoring, 594–595
- Organizational Process Definition, 617–618
- Organizational Process Focus, 641–643
- Organizational Training and Awareness, 671–673
- People Management (PM), 701–703

perform resilience oversight, 323–325

provide resilience oversight, 321–322

- Resilience Requirements Development, 757–758
- Resilience Requirements Management, 779–780
- Resilient Technical Solution Engineering, 814–815
- risk and crisis oversight and, xvi
- Risk Management, 734–735
- Service Continuity, 853–855
- Technology Management, 899–901
- Vulnerability Analysis and Resolution, 929–930

grid modernization, electric power industry, 103–104

guidance, using CERT-RMM as basis for, 78–79

guidelines. *See also* standards for configuration management, 886

establish tailoring criteria and, 610–612

- for handling information assets, 517
- for integrated teams, 615–616
- for monitoring, 589–591
- for resilience, 320–321
- for service continuity, 835

guidelines, for resilient technical solutions

- identify architecture and design guidelines, 801–802
- identify assembly and integration guidelines, 805–807
- identify general guidelines, 798–800
- identify implementation guidelines, 802–805
- identify requirements guidelines, 800–801
- integrating selected guidelines with software and system development process, 809–810
- select and tailor, 808–809

H

hardware, integrity of, 882

hazards, service continuity planning and, 832

higher-level managers, reviewing with

- Access Management, 172
- Asset Definition and Management, 145
- Communications, 206
- Compliance, 238
- Controls Management, 268–269
- Enterprise Focus, 337
- Environmental Control, 304
- External Dependencies Management, 378
- Financial Resource Management, 409
- generic goals and practices, 953
- Human Resource Management, 445
- Identity Management, 471
- Incident Management and Control, 509
- Knowledge and Information Management, 547
- Measurement and Analysis, 575
- Monitoring, 603
- Organizational Process Definition, 627
- Organizational Process Focus, 651
- Organizational Training and Awareness, 683
- People Management (PM), 714
- Resilience Requirements Development, 768
- Resilience Requirements Management, 790–791
- Resilient Technical Solution Engineering, 827
- Risk Management, 744
- Service Continuity, 865
- Technology Management, 912
- Vulnerability Analysis and Resolution, 940

Highfill, Darren, 99–100

high-value assets

- defined, 973
- metrics for, 893

high-value information, encryption of, 524–525

high-value services

- defined, 973
- as focus of CERT-RMM, 29
- identify and prioritize, 835–836
- identify internal and external dependencies and interdependencies, 837
- identify vital organizational records and databases, 837–839
- prioritization of technology assets related to, 871–872
- resilience requirements for, 33–35

Human Resource Management (HRM)

- achieve specific goals, 433
- address skill deficiencies, 416–418
- assign responsibility for, 437–438
- collect improvement information, 445–446
- defined, 973
- Enterprise Management and, 54–55
- establish baseline competencies, 414–415
- establish defined process, 445
- establish disciplinary process, 426–427
- establish process governance, 433–435
- establish resilience as job responsibility, 423
- establish resilience performance goals/objectives, 423–425
- establish resource needs, 413
- identify and involve relevant stakeholders, 441–442
- insider threats and, 963–964
- introductory notes, 411–412
- inventory skills and identify gaps, 415–416
- manage changes to employment status, 412, 427–432
- manage staff acquisition, 418–422
- manage staff performance. *See* performance, in staff management
- manage work product configurations, 440–441
- measure and assess performance, 425–426

Human Resource Management (HRM)
(*contd.*)
monitor and control the process,
442–444
objectively evaluate adherence, 444
plan the process, 435–436
provide resources for, 436–437
purpose of, 411
related process areas, 412
review status with higher-level
managers, 445
summary of specific goals and
practices, 413
train people for, 439–440

I

icons, process area, 42–43

IDEAL model, 82–83

identify and involve relevant
stakeholders. *See* stakeholders,
identify and involve

identities

assign roles to, 453–454
correct inconsistencies in, 457–459
creating, 450–451
defined, 973
deprovision, 459–460
establish identity community,
452–453
manage, 454
monitor and manage changes to,
455–456
overview of, 449–450
periodically review/maintain,
456–457
identity community
assigning roles to identities,
453–454
correcting inconsistencies in,
457–459
defined, 973
establishing, 452–453
monitoring and managing changes
in, 455–456
periodic review of, 456–457

Identity Management (IM). *See also*
Access Management (AM); Risk
Management (RISK)
achieve specific goals, 460
assign responsibility for, 464–465
assign roles to identities, 453–454
collect improvement information,
471–472
create identities, 450–451
defined, 973
enable access request and
approval, 152
establish defined process, 471
establish identities, 449–450

establish identity community,
452–453
establish process governance,
460–462
FISMA compliance, 958
identify and involve relevant
stakeholders,
467–468
introductory notes, 447–449
manage work product
configurations, 466–467
monitor and control the process,
468–470
monitoring needs of, 586
objectively evaluate adherence,
470–471
as Operations process area, 57
plan the process, 462
provide resources for, 462–464
purpose of, 447
related process areas, 449
review status with higher-level
managers, 471
specific goals and practices, 449
train people for, 465–466
identity profiles, 973
identity registration, 974
identity repository, 974
IM. *See* Identity Management (IM)
IMC. *See* Incident Management and
Control (IMC)
impact valuation, 974
implementation guidelines, for
resilient software
and systems, 802–805
improvement information, collecting
Access Management, 173–174
Asset Definition and Management,
146–147
Communications, 207–208
Compliance, 239–240
Controls Management, 269–270
Enterprise Focus, 338–339
Environmental Control, 304–305
External Dependencies
Management, 379–380
Financial Resource Management,
410
generic goals and practices, 955
Human Resource Management,
445–446
Identity Management, 471–472
Incident Management and Control,
510–511
Knowledge and Information
Management, 548–549
Measurement and Analysis, 576
Monitoring, 604–605
Organizational Process Definition,
628

Organizational Process Focus, 652
Organizational Training and
Awareness, 684
People Management, 714–715
for process areas, 202
Resilience Requirements
Development, 769
Resilience Requirements
Management, 791–792
Resilient Technical Solution
Engineering, 828–829
Risk Management, 745–746
Service Continuity, 866–867
Technology Management, 913–914
Vulnerability Analysis and
Resolution, 940–941

improvement mind-set, benefits of
CERT-RMM, 6

inappropriate behavior, identifying
staff risks, 691

incident closure, 492–493, 974

incident declaration
analyzing incidents, 485–486
criteria for, 484–485
to support response, 483–484

incident escalation
communications and, 187
defined, 974
Incident Management and Control,
487–488

incident life cycle, 974

Incident Management and Control
(IMC)

achieve specific goals, 497
analyze and triage events, 482–483
analyze incidents, 485–486
assign responsibility for, 501–502
assign staff for, 477–478
close incidents, 492–493
collect, document, and preserve
event evidence, 481–482
collect improvement information,
510–511
communicate incidents, 490–492
declare events for response
planning, 483–484
define criteria for event declaration,
484–485
defined, 974
detect and report events, 478–479
escalate incidents, 487–488
establish defined process, 510
establish process for, 475–476
establish process governance,
497–498
FISMA compliance, 959
identify and involve relevant
stakeholders, 504–506
identify communications
requirements, 180

- integrate incident handling with
 - problem management, 494–495
- introductory notes, 473–475
- learn from incidents, 493
- log and track events, 480–481
- manage work product
 - configurations, 504
- monitor and control the process, 506–508
- monitoring needs of, 586
- objectively evaluate adherence, 508–509
- plan for, 476–477
- plan the process, 498–499
- post-incident review, 493–494
- provide resources for, 499–500
- purpose of, 473
- related process areas, 475
- relationships driving threat/incident management, 57–58
- respond to/ recover from incidents, 487–490
- review status with higher-level managers, 509
- summary of specific goals and practices, 475
- train people, 502–503
- translate lessons into strategy, 495–496
- incident owner, 974
- incident response
 - closing incidents, 492–493
 - communication in, 490–492
 - defined, 974
 - developing and implementing, 488–490
 - escalation of incidents, 487–488
 - establishing process for, 487
- informal stakeholder, 974
- incidents, 974
- incomplete process, capability level 0, 70
- informal diagnosis, of current
 - resilience practices, 94–95
- information. *See also* Asset Definition and Management (ADM) and Knowledge and Information Management (KIM)
 - access privileges focusing on, 153
 - as asset in CERT-RMM, 31–32
 - establishing compliance
 - knowledgebase or repository, 220–221
 - identifying external dependencies, 344–347
 - life-cycle of, 37
 - objective views for, 59, 61
 - processing cycle, 529–530
 - protecting and sustaining, 35–36
 - resilience requirements for, 33–35
 - information asset baseline, 974
 - information asset categorization, 975
 - information asset container, 975
 - information asset owner, 975
 - information assets
 - defining. *See* Asset Definition and Management (ADM)
 - definition of, 974
 - managing. *See* Knowledge and Information Management (KIM)
 - information technology. *See* IT (information technology)
 - informative component
 - defined, 975
 - overview of, 43–44
 - summary of, 48
 - infrastructure
 - for communications, 190–191
 - managing dependencies on public, 288–289
 - for monitoring, 588–589
 - initialisms, acronyms used in this book, 989–992
 - initiating phase, process improvement. *See also* objectives, setting and communicating, 82
 - insider threats, 963
 - inspections, product release and, 812–813
 - institutional knowledge. *See* organizational and intellectual knowledge
 - institutionalization
 - capability levels and, 68–69
 - CERT-RMM as organizing structure for, 80
 - CERT-RMM generic goals and practices, 73–74
 - connecting capability levels to, 69–73
 - defined, 975
 - defined process. *See* defined process managed process. *See* managed process
 - overview of, 67
 - process areas supporting generic practices, 74–75
 - instructors
 - for awareness program, 659–660
 - for training program, 667
 - intangible assets, stress of managing, 22
 - integrated teams, establish rules and guidelines for, 615–616
 - integration guidelines, for Resilient Technical Solution Engineering, 805–807
 - integrity
 - checks, 221, 562
 - data analysis and, 561–562
 - defined, 975
 - Knowledge and Information Management and, 513
 - of measurement information, 564
 - integrity, of technology assets
 - access controls, 882–883
 - overview of, 881–882
 - perform change management, 887–888
 - perform configuration management, 883–887
 - perform release management, 889–890
 - integrity of information assets
 - attributes, 514
 - configuration management, 529
 - modification management, 527–528
 - overview of, 527
 - validity and reliability, 529–530
 - intellectual property
 - contrasted with institutional knowledge, 532
 - defined, 975
 - protecting, 513
 - interdependencies, identify internal and external dependencies, 837
 - internal communications. *See also* Communications (COMM), 186–187
 - internal control system
 - assessing effectiveness of, 253–254
 - defined, 975
 - implementing for facility assets, 277–280
 - overview of, 241–242
 - interoperability
 - defined, 986
 - of technology assets, 897–899
 - interviews, to assess effectiveness of awareness program, 662
 - Introducing the CERT Resiliency Engineering Framework: Improving the Security and Sustainability Processes* (Caralli 2007), 12
 - inventory. *See also* repositories
 - of assets, 124–125
 - of compliance obligations, 216–217
 - maintaining changes to assets and, 133–134
 - of service continuity plans, 843
 - of skills, 415–416, 985
 - of staff, 688
 - of stored data, 564
 - investigation reports, in establishing disciplinary process, 427
 - investments, resilience
 - determining return on, 396–397

investments, resilience (*contd.*)
 identify cost recovery opportunities,
 397–398
 optimize resilience expenditures
 and, 394–396
 involuntary termination of
 employment
 managing, 431–432
 overview of, 428
 IT (information technology)
 evolution of CERT-RMM, 9–12
 managing operational risk for, 23
 as traditional focus of operational
 risk management, 8–9

J

job descriptions
 creating to reflect base
 competencies, 415
 developing requisitions for unfilled
 positions, 417–418
 establishing terms and conditions of
 employment, 420–422
 incident management plan
 and, 477
 inserting resilience obligations
 in, 423
 updating to incorporate missing
 skills, 417
 job-specific verification criteria,
 419–420

K

key control indicators (KCIs)
 defined, 975
 performing resilience oversight, 325
 key indicators
 establish corrective actions, 325–326
 perform resilience oversight, 325
 key performance indicators (KPIs),
 325
 key risk indicators (KRIs)
 defined, 975
 performing resilience oversight, 325
 Knowledge and Information
 Management (KIM)
 access controls for information
 assets, 525–526
 achieve specific goals, 533
 assign responsibility for, 538–539
 availability of information assets,
 530–531
 categorize information assets,
 517–518
 Cloud Computing and, 963
 collect improvement information,
 548–549
 confidentiality and privacy
 considerations, 523–524

configuration management, 529
 controls for information assets,
 519–521
 defined, 975
 disposal management, 526–527
 document organizational and
 intellectual knowledge of
 staff, 532–533
 duplication and retention of
 information assets, 531–532
 encrypt high-value information,
 524–525
 establish defined process for,
 547–548
 establish process governance,
 534–536
 FISMA compliance, 959
 identify and assess risks, 522
 identify and involve relevant
 stakeholders, 542–543
 integrity management, 527
 introductory notes, 513–514
 manage work product
 configurations, 541
 mitigate risks, 523
 modification management, 527–528
 monitor and control the process,
 543–545
 objectively evaluate adherence, 546
 as Operations process area, 57
 plan the process, 536
 prioritize information assets,
 516–517
 protect information assets, 518–519
 provide resources for, 536–538
 purpose of, 513
 related process areas, 514–515
 resilience requirements for
 information assets, 519
 review status with higher-level
 managers, 547
 risk management and, 521
 summary of specific goals and
 practices, 515
 train people for, 540–541
 validity and reliability of
 information assets, 529–530
 knowledgebase
 for compliance data, 220
 for incident management, 481

L

labor, funding resilience activities, 391
 laws
 documenting events and, 481–482
 external dependencies management,
 362
 stress of managing operational
 risk, 23
 layering, of controls, 247

learning
 from incidents and events, 493
 integrating incident handling with
 problem management,
 494–495
 lessons learned and communicated,
 639–640
 overview of, 493
 post-incident review, 493–494
 translating lessons into strategy,
 495–496
 learning phase, process improvement,
 82–83
 legal issues. *See* laws
 libraries, process asset, 613–614
 licensing agreements, with external
 entities, 360–362
 life-cycle
 addressing resilience for software
 assurance, 104–110
 of assets, 794
 integration of resilience
 requirements in, 797
 resilience of, 36–39
 line of business, 976
 Lockheed Martin Corporation, using
 CERT-RMM, 110–115
 logs
 asset modification, 883–884
 configuration management, 887
 Incident Management and Control,
 480–481

M

MA. *See* Measurement and Analysis
 (MA)
 maintenance
 adaptive, 285, 966
 of infrastructure, 190–191
 perfective, 285, 979
 preventive, 285, 979
 of service continuity tests, 851
 of technology assets, 894–895
 manage work product configurations.
 See work product configurations
 managed process
 as capability level 2, 70–72
 defined, 976
 management
 developing operational resilience
 plan for, 314–316
 identity. *See* identity management
 of risks due to external
 dependencies, 349–350
 management, preparing for
 communications
 establish plan, 183–185
 establish program, 185–186
 identify and plan staff, 186–188
 overview of, 183

- management, preparing for compliance
 - establish guidelines and standards, 214
 - establish plan, 211–212
 - establish program, 212–214
 - overview of, 210–211
- managers
 - identifying vital, 689
 - process governance and, 946
 - review with higher-level. *See* higher-level managers, reviewing with
- Managing for Enterprise Security*, (Caralli 2004), 11
- maturity advantage, of CERT-RMM, 7
- maturity models
 - CERT-RMM objectives vs., 12
 - CERT-RMM vs., 18–19
 - characteristics setting CERT-RMM apart from other, 113
 - raising bar on business resilience, 111–112
- measurement. *See also* improvement information, collecting
 - for assessing performance, 425–426
 - benefits of CERT-RMM, 5–7
 - effectiveness of service continuity plans, 851
 - establish corrective actions, 325–326
 - establish risk measurement criteria, 722–723
 - objectives, 976
 - of operational resistance, 115–118
 - perform resilience oversight, 324–325
 - repository, 612–613
- Measurement and Analysis (MA)
 - Access Management and, 170–171
 - achieve specific goals, 565
 - align activities with information needs and objectives, 553
 - analysis procedures for, 559–561
 - analyze measurement data, 562–563, 640
 - assign responsibility for, 569–570
 - collect improvement information, 576
 - collect measurement data, 561–562
 - communicate results, 564–565
 - data collection and storage procedures for, 557–559
 - defined, 976
 - establish defined process for, 575–576
 - establish objectives, 553–555
 - establish process governance, 566–567
 - identify and involve relevant stakeholders, 571–573
 - introductory notes, 551–552
 - manage work product configurations, 571
 - measurement results, 561
 - measures for, 556–557
 - measuring operational resistance using CERT-RMM, 115–118
 - monitor and control the process, 573–574
 - monitor asset definition and management process, 142–144
 - objectively evaluate adherence, 574–575
 - plan the process, 567
 - as Process Management, 59
 - provide resources for, 567–569
 - purpose of, 551
 - related process areas, 552
 - review status with higher-level managers, 575
 - store data and results, 563–564
 - summary of specific goals and practices, 552
 - train people for, 570–571
- measurement results
 - analyze data, 562–563
 - collect data, 561–562
 - communicate, 564–565
 - overview of, 561
 - store data and results, 563–564
- measures
 - base measures, 556, 561–562, 967
 - classes of commonly used, 612–613
 - defined, 976
 - derived measures, 556, 561–562, 563, 971
 - overview of, 556–557
- media, distribution methods and, 593
- Mehravari, Dr. Nader, PhD, 109–110
- memoranda of agreement, with external entities, 360–362
- methods. *See also* tools, techniques, and methods
 - controls management, 261
 - environmental control, 295
 - establishing infrastructure for communications, 190–191
 - identify communications, 188–190
- metrics. *See also* improvement information, collecting; monitor and control
 - capacity planning, 896
 - for high-value technology assets, 893
 - measure and assess performance with, 425–426
 - Measurement and Analysis, 551
 - for monitoring process, 602
 - for operational resistance, 117–118
 - performing resilience oversight, 324–325
- misuse/abuse case, 976
- mitigation
 - conflict mitigation plans, 755
 - for external dependencies, 352
 - for facility assets, 281–282
 - implement risk strategies, 731
 - risk mitigation plans, 729–731
 - of risks, 729
 - of staff risks, 692–693
 - of technology asset risks, 880–881
- model components. *See* components, model
- model relationships
 - model view. *See* model view
 - objective views. *See* objective views, for assets
 - overview of, 53–54
- model scope
 - asset scope, 89–90
 - defined, 84, 976
 - establishing improvement objective with, 87–88
 - practice-level scope, 88–89
 - resilience scope, 89–90
 - targeted improvement roadmaps, 88
- model view
 - defined, 54
 - Engineering process areas, 56
 - Enterprise Management process areas, 54–55
 - Operations process areas, 56–57
 - Process Management, 57–59
- model-based process improvement, using CERT-RMM for, 80–83
- modification management, for information assets, 527–528
- MON. *See* Monitoring (MON)
- monitor and control
 - Access Management, 169–171
 - Asset Definition and Management, 142–144
 - Communications, 203–205
 - Compliance, 225–226, 236–237
 - controls for information assets, 521
 - Controls Management, 265–266
 - Enterprise Focus, 333–336
 - Environmental Control, 300–302
 - event detection and, 478–479
 - execution of software and system development plan, 810–812
 - External Dependencies Management, 375–377
 - Financial Resource Management, 406–407
 - generic goals and practices, 951–953
 - Human Resource Management, 442–444
 - for identity changes, 455–456

monitor and control (*contd.*)

- Identity Management, 468–470
 - Incident Management and Control, 506–508
 - Knowledge and Information Management, 543–545
 - Measurement and Analysis, 573–574
 - Monitoring, 601–603
 - Organizational Process Definition, 624–626
 - Organizational Process Focus, 649–650
 - Organizational Training and Awareness, 680–682
 - People Management, 711–713
 - performing resilience oversight, 324–325
 - process implementation and, 639
 - Resilience Requirements Development, 765–766
 - Resilience Requirements Management, 787–789
 - Resilient Technical Solution Engineering, 823–826
 - Risk Management, 741–743
 - risks to information assets, 522
 - Service Continuity, 862–864
 - software and systems, 795
 - Technology Management, 909–911
 - Vulnerability Analysis and Resolution, 937–939
- Monitoring (MON)
- achieve specific goals, 594
 - analyze and prioritize requirements for, 585–587
 - assign responsibility for, 597–598
 - collect and record information, 591–592
 - collect improvement information, 604–605
 - defined, 976
 - develop resilient software across life cycle with, 108
 - distribute information, 592–594
 - establish collection standards and guidelines, 589–591
 - establish defined process, 604
 - establish process governance, 594–595
 - establish requirements for, 583–585
 - establishing/maintaining program for, 578–581
 - establish/maintain infrastructure for, 588–589
 - FISMA compliance, 959
 - identify and involve relevant stakeholders, 581–582, 600–601
 - introductory notes, 577–578

- manage work product configurations, 599–600
- monitor and the control process, 601–603
- objectively evaluate adherence, 603
- performance of, 587–588
- plan the process, 596
- as Process Management, 59
- provide resources for, 596–597
- purpose of, 577
- related process areas, 578
- relationships driving resilience at enterprise level, 55
- relationships driving threat/incident management, 58
- review status with higher-level managers, 603
- summary of specific goals and practices, 578
- train people for, 598–599
- monitoring infrastructure, 976
- monitoring requirements, 976
- monitoring stakeholder, 976
- Moss, Michele, 104–105

N

- natural disasters
 - availability of technology assets and, 890–891
 - identifying staff risks, 691
- NERC (North American Electric Reliability Corporation), 100, 102
- non-compliance
 - demonstrating extent of compliance obligation satisfaction, 221–223
 - evaluate adherence to compliance process, 238
 - remediate areas of, 223–225
 - requirements for identifying and documenting risks of, 214
- North American Electric Reliability Corporation (NERC), 100, 102
- notes, process area defined, 47–48
- typographical and structural conventions, 51
- notification communications, 187
- numbering scheme, process areas, 47–49

O

- objective views, for assets
 - facilities, 60–61, 63–64
 - information, 59, 61
 - people, 59–60
 - perspectives addressed by, 59
 - technology, 60, 62

- objectively evaluate adherence. *See* also adherence, objective evaluation of
- objectives, measurement and analysis
 - aligning needs by objectives, 553
 - establishing, 553–555
 - updating, 559
- objectives, setting and communicating
 - capability level targets, 90–92
 - model scope, 87–90
 - organizational objectives, 84–85
 - organizational scope, 85–87
 - overview of, 83–85
 - relating process needs to, 631
 - using CERT-RMM for strategic/operational, 78
- objects, creating identities for. *See* Identity Management (IM)
- obligations, compliance
 - analyzing, 217–218
 - assign responsibility for, 231–232
 - collect and validate compliance data, 219–221
 - demonstrate extent of satisfaction with, 221–223
 - developing plan for managing, 211–212
 - establish ownership for meeting, 218–219
 - evaluate adherence to, 238
 - identify and document, 215–217
 - monitor activities, 225–226
 - remediate areas of non-compliance, 223–225
- OCTAVE (Operationally Critical Threat, Asset, and Vulnerability Evaluation) method, CERT, 10
- off-budget request for funds, process for, 391
- off-cycle request for funds, process for, 391
- online references
 - CERT-RMM, 12
 - The Crosswalk, 13
 - developing resilient software across life cycle, 108–109
- OPD. *See* Organizational Process Definition (OPD)
- open borders, stress of managing globalization risks, 22–23
- operational constraints, 976
- operational controls, 242
- operational environments
 - identifying vulnerabilities, 917–918
 - maintain environmental conditions, 285–286
 - manage dependencies on public infrastructure, 288–289
 - manage dependencies on public services, 287
 - overview of, 282–283

- perform facility sustainability planning, 284–285
- plan for facility retirement, 289–290
- operational objectives
 - establish scope of improvement, 84
 - using CERT-RMM to support, 78
- operational resilience, 976–977
- operational resilience management
 - applying risk information to, 731–732
 - assets, 30–33
 - business processes, 29–30
 - CERT-RMM v1.1 introducing system of, 12
 - as competitive differentiator, xvi
 - concept of, 25–27
 - defined, 105, 977
 - developing program for, 316–317
 - governing. *See* Enterprise Focus (EF)
 - identifying resilience requirements. *See* Resilience Requirements Development (RRD)
 - incident management and, 473–474
 - life-cycle coverage, 36–39
 - managing resilience requirements. *See* Resilience Requirements Management (RRM)
 - managing risk, 717
 - measuring using CERT-RMM, 115–118
 - monitoring and, 577, 583
 - resilience requirements, 33–35
 - services, 27–29
 - strategies for protecting/sustaining assets, 35–36
 - training and awareness and, 653
- operational resilience process group (ORPG), 617, 672
- operational resilience requirements
 - Access Management and, 155–156
 - asset disposal and, 526
 - for assets. *See* Resilience Requirements Development (RRD)
 - assign to technology assets, 875–876
 - change management, 131
 - Communications and, 179–181, 183–184
 - defined, 977, 982
 - driving operational resilience through, 33–35
 - establishing, 26–27
 - for facility assets, 276–277
 - identify inconsistencies in meeting, 778
 - for information assets, 518–519
 - maintain traceability of, 776–777
 - manage changes to, 775–776
 - Measurement and Analysis and, 554
 - obtain commitment to, 774–775
 - for software and system development, 797
 - for software and systems, 800–801
 - understanding, 773–774
- operational risk
 - common problems of, 3–4
 - defined, 25–26, 977
 - how CERT-RMM solves problems of, 5–6
 - managing. *See* Risk Management (RISK)
 - overview of, 2–3
 - to technology assets, 878–881
- Operationally Critical Threat, Asset, and Vulnerability Evaluation (OCTAVE) method, CERT, 10
- Operations process areas
 - AM. *See* Access Management (AM)
 - defined, 7–8
 - EC. *See* Environmental Control (EC)
 - EXD. *See* External Dependencies Management (EXD)
 - IM. *See* Identity Management (IM)
 - IMC. *See* Incident Management and Control (IMC)
 - KIM. *See* Knowledge and Information Management (KIM)
 - model view of, 56–57
 - overview of, 42–43
 - PM. *See* People Management (PM)
 - TM. *See* Technology Management (TM)
 - VAR. *See* Vulnerability Analysis and Resolution (VAR)
- OPF. *See* Organizational Process Focus (OPF)
- optimization of resilience
 - expenditures/investments
 - determining return on resilience investments, 396–397
 - identify cost recovery opportunities, 397–398
 - optimize resilience expenditures, 394–396
 - overview of, 394
- organizational and intellectual knowledge, of staff, 532–533
- organizational assets. *See also* Asset Definition and Management
 - creating identities for access to, 449–451
 - defined, 978
 - enable access to, 152–155
 - establish common understanding of, 126–128
 - establish ownership and custodianship, 128–130
 - establishing, 123–124
 - inventory assets, 124–126
 - manage and control access to, 151–152
 - returning upon departure from job, 430–431
- organizational impact area. *See* area of impact
- organizational objectives, 84–85
- organizational process assets
 - establish measurement repository, 612–613
 - establish process asset library, 613–614
 - establish rules and guidelines for integrated teams, 615–616
 - establish work environment standards, 614–615
 - establishing, 608
 - set of standard processes, 608–610
 - tailoring criteria and guidelines, 610–612
- Organizational Process Definition (OPD)
 - Access Management and, 173–174
 - achieve specific goals, 617
 - assign responsibility for, 620–621
 - collect improvement information, 628
 - defined, 978
 - establish defined process, 627–628
 - establish measurement repository, 612–613
 - establish process asset library, 613–614
 - establish process governance, 617–618
 - establish rules and guidelines for integrated teams, 615–616
 - establish standard processes, 608–610
 - establish tailoring criteria and guidelines, 610–612
 - establish work environment standards, 614–615
 - identify and involve relevant stakeholders, 623–624
 - introductory notes, 607
 - manage work product configurations, 623
 - monitor and control the process, 624–626
 - objectively evaluate adherence, 626–627
 - plan the process, 619
 - as Process Management, 59
 - provide resources for, 619–620
 - purpose of, 607
 - related process areas, 608
 - review status with higher-level managers, 627

Organizational Process Definition (OPD) (*contd.*)
 summary of specific goals and practices, 608
 train people for, 621–623
 Organizational Process Focus (OPF)
 Access Management and, 173–174
 achieve specific goals, 641
 appraise organizational processes, 632–633
 Asset Definition and Management, 145
 assign responsibility for, 645–646
 collect improvement information, 652
 deploy process assets, 636–637
 deploy standard processes, 638
 determine process improvement opportunities, 630
 establish defined process, 652
 establish process action plans, 634–635
 establish process governance, 641–643
 establish process needs, 631–632
 identify and involve relevant stakeholders, 648–649
 identify improvements to processes, 633–634
 implement process action plans, 636
 incorporate experiences into process assets, 639–641
 introductory notes, 629–630
 manage work product configurations, 647–648
 monitor and control the process, 649–650
 monitor process implementation, 639
 objectively evaluate adherence, 651
 plan and implement process actions, 634
 plan the process, 643
 as Process Management, 59
 provide resources for, 643–645
 purpose of, 629
 review status with higher-level managers, 651
 summary of specific goals and practices, 630
 train people for, 646–647
 organizational process maturity, 978
 organizational scope
 defined, 978
 overview of, 84–87
 organizational sensitivity. *See* sensitivity
 organizational subunits
 defined, 978
 in organizational scope, 86
 planning practice instantiation, 96

organizational superunits
 defined, 979
 in organizational scope, 86
 planning practice instantiation, 96
 Organizational Training and Awareness (OTA)
 Access Management and, 164, 167
 achieve specific goals, 671
 assess effectiveness of awareness program, 662–663
 assess effectiveness of training program, 670–671
 Asset Definition and Management and, 137, 140
 assign responsibility for, 676–677
 collect improvement information, 684
 conduct training, 668
 defined, 979
 deliver resilience training, 668–669
 Enterprise Management and, 54–55
 establish awareness delivery capability, 658–660
 establish awareness needs, 655–657
 establish awareness plan, 657–658
 establish defined process for, 683
 establish process governance, 671–673
 establish training capability, 666–668
 establish training needs, 664–665
 establish training plan, 665–666
 establish training records, 669–670
 FISMA compliance, 960
 identify and involve relevant stakeholders, 679–680
 Incident Management and Control and, 510–511
 introductory notes, 653–654
 Knowledge and Information Management and, 548–549
 manage work product configurations, 678–679
 Measurement and Analysis and, 576
 monitor and control the process, 680–682
 Monitoring and, 604–605
 objectively evaluate adherence, 682–683
 Organizational Process Definition and, 628
 Organizational Process Focus and, 652
 perform awareness activities, 660–661
 perform awareness records, 661–662
 plan the process, 673–674
 provide resources for, 674–675
 purpose of, 653
 related process areas, 654

review status with higher-level managers, 683
 summary of specific goals and practices, 655
 train people for, 677–678
 organizational units
 defined, 979
 deploying standard processes to, 638
 in organizational scope, 85–87
 planning practice instantiation, 96
 standard processes tailored by, 607–608
 organizationally high-valued services.
See high-value services
 organizations
 defined, 977
 process asset library. *See* process asset library
 role in External Dependencies Management, 341–343
 standard processes. *See* standard processes
 ORPG (operational resilience process group), 617, 672
 OTA. *See* Organizational Training and Awareness (OTA)
 overhead allocation, funding resilience activities, 391
 oversight, resilience
 establish corrective actions, 325–326
 as governance focus area, 322–323
 for operational resilience management program, 317
 overview of, 321
 performing, 323–325
 ownership
 of access management, 152, 156, 168–169
 of asset definition and management, 126–130
 of compliance, 231–232
 of compliance obligations, 218–219
 defining, 32–33
 of environmental control, 296–297
 planning and, 946

P

partnerships, operational resilience management and, 2
 passwords, access control via, 525
 patch management, 889
 PDCA (Plan, Do, Check, Act) cycle, 80–81, 82–83
 peer pressure, 101–103
 people
 as asset. *See* Asset Definition and Management (ADM), People Management (PM), and Human Resource Management (HRM)
 as asset in CERT-RMM, 31–32

- creating identities for. *See* Identity Management (IM)
- as critical dimension of organizations, 8–9
- as human resource. *See* Human Resource Management (HRM)
- life-cycle, 37
- objective views for, 59–60
- protecting and sustaining, 35–36
- resilience requirements for, 33–35
- People Management (PM)
 - achieve specific goals, 701
 - assign responsibility for, 706–707
 - collect improvement information, 714–715
 - defined, 412, 979
 - establish defined process for, 714
 - establish process governance, 701–703
 - establish redundancy for vital staff, 694–695
 - establish vital staff, 687–690
 - identify and assess staff risks, 691–692
 - identify and involve relevant stakeholders, 710–711
 - insider threats and, 964
 - introductory notes, 685–686
 - manage staff availability, 693–694
 - manage work product
 - configurations, 709
 - mitigate staff risks, 692–693
 - monitor and control the process, 711–713
 - objectively evaluate adherence, 713
 - as Operations process area, 57
 - perform succession planning, 695–697
 - plan for return-to-work following disruptive events, 700–701
 - plan the process, 703–704
 - plan to support staff during disruptive events, 698–700
 - prepare for redeployment, 697–698
 - provide resources for, 704–706
 - purpose of, 685
 - related process areas, 686–687
 - review status with higher-level managers, 714
 - summary of specific goals and practices, 787
 - train people for, 707–709
- perfective maintenance
 - defined, 979
 - of environmental conditions, 285
- perform specific practices, generic goals and practices, 945
- performance
 - analysis for funded resilience management activities, 393–394
 - corrective actions for poor, 325–326
 - management of staff, 411
 - managing external entity, 363–365
 - measuring against plan, 573
 - measuring and assessing, 425–426
 - performance, in staff management
 - establish disciplinary process, 426–427
 - establish resilience as job responsibility, 423
 - establish resilience performance goals/objectives, 423–425
 - measure and assess performance, 425–426
 - overview of, 411, 422–423
 - performed processes
 - defined, 979
 - managed processes vs., 71–72
 - overview of, 70
 - periodic reviews. *See* reviews
 - physical controls
 - access control via, 525
 - defined, 979
 - at enterprise/service/asset levels, 248–250
 - establishing and managing. *See* Environmental Control (EC)
 - for facility assets, 277, 279
 - for information assets, 519–521
 - overview of, 247
 - for technology assets, 876–878
- Plan, Do, Check, Act (PDCA) cycle, 80–81, 82–83
- plan the process
 - Access Management, 163
 - Asset Definition and Management, 136–137
 - Communications, 183–184, 197–198
 - Compliance, 211–212, 229
 - Controls Management, 259
 - Enterprise Focus, 328
 - Environmental Control, 292–293
 - External Dependencies Management, 368
 - for facility retirement, 289–290
 - Financial Resource Management, 400
 - generic goals and practices, 946–947
 - Human Resource Management, 435–436
 - Identity Management, 462
 - Incident Management and Control, 498–499
 - Knowledge and Information Management, 536
 - Measurement and Analysis, 567
 - Monitoring, 596
 - for operational resilience management system, 314–317
 - Organizational Process Definition, 619
 - Organizational Process Focus, 643
 - Organizational Training and Awareness, 673–674
 - People Management, 703–704
 - remediating areas of non-compliance, 224
 - Resilience Requirements Development, 758–759
 - Resilience Requirements Management, 780–781
 - Resilient Technical Solution Engineering, 816
 - Risk Management, 735
 - Service Continuity, 855
 - Technology Management, 901–902
 - Vulnerability Analysis and Resolution, 930–931
- planned downtime, 890, 979
- planning CERT-RMM-based improvements, 95–97
- plans
 - awareness, 657–658
 - capacity, 896
 - control revision, 732
 - development plans. *See* development plans, for resilient technical solutions
 - process actions, 634
 - risk mitigation, 692–693, 729–731
 - service continuity, 697–698, 733
 - succession, 695–697
 - sustaining technology assets, 891–894
 - training, 665–666
- plans, financial
 - defining funding needs, 387–388
 - establishing resilience budgets, 388–389
 - for funding resilience management activities, 386–387
 - resolving funding gaps, 389–390
- plans, for disruptive events
 - staff return-to-work, 700–701
 - staff support, 698–700
- PM. *See* People Management (PM)
- policies
 - change management, 887–888
 - Compliance, 216
 - configuration management, 886
 - Controls Management, 259
 - developing and publishing for compliance, 228
 - Enterprise Focus, 328
 - environmental control, 291–292
 - External Dependency Management, 367
 - Financial Resource Management, 385–386, 391, 399–400

- policies (*contd.*)
 - Human Resource Management, 434–435
 - identify compliance obligations, 215–216
 - Identity Management, 461–462
 - Incident Management and Control, 498
 - information assets, 518
 - internal control, 241–242
 - Knowledge and Information Management, 535
 - Measurement and Analysis, 567
 - Monitoring, 595
 - Organizational Process Definition, 618
 - Organizational Process Focus, 642–643
 - Organizational Training and Awareness, 673
 - People Management, 702–703
 - release management, 889–890
 - Resilience Requirements Development, 758
 - Resilience Requirements Management, 780
 - Resilient Technical Solution Engineering, 815
 - Risk Management, 735
 - Service Continuity, 854–855
 - sponsoring resilience, 320–321
 - standard processes adhering to, 610
 - Technology Management, 901
 - Vulnerability Analysis and Resolution, 930
- post-incident review, 493–494, 979
- practice-level scope, 88–90
- practices
 - damage of evaluation based on, 9–10
 - defining CERT-RMM, 14–15
 - generic. *See* generic goals and practices
 - limitations of organizations focused on, 9
 - organizing structure for deployed, 79–80
 - planning instantiation of, 95–96
- pre-employment verification of staff, 418–419
- preventive controls, 247–248
- preventive maintenance
 - defined, 979
 - of environmental conditions, 285
- prioritization
 - of candidates for process improvement, 634
 - of control objectives, 246
 - of data collection/storage, 559
 - of external dependencies, 348–349
 - of high-value services, 835–836
 - of information assets, 516–517
 - of measures, 557
 - of monitoring requirements, 585–587
 - of risk, 727
 - of risks, 726
 - of staff, 687
 - of vulnerabilities, 924–925
- prioritization, of technology assets
 - establish resilience-focused technology assets, 873–874
 - overview of, 871–873
- privacy
 - access controls and, 526
 - attributes of information assets, 514
 - defined, 979
 - of information assets, 523–524
- privileges. *See* access privileges
- problem management
 - defined, 980
 - integrating incident handling with, 494–495
- procedures
 - as critical dimension of organizations, 8–9
 - for handling information assets, 517
- process actions
 - establish action plans, 634–635
 - implement action plans, 636
 - planning and implementing, 634
- process architecture, 610, 980
- process areas
 - ADM. *See* Asset Definition and Management (ADM)
 - AM. *See* Access Management (AM)
 - arranging in model view, 54–59
 - by category, 41–42
 - in CERT-RMM and CMMI models, 12–15
 - COMM. *See* Communications (COMM)
 - COMP. *See* Compliance (COMP)
 - component categories, 42–44
 - component descriptions, 44–47
 - CTRL. *See* Controls Management (CTRL)
 - defined, 980
 - EC. *See* Environmental Control (EC)
 - EF. *See* Enterprise Focus (EF)
 - EXD. *See* External Dependencies Management (EXD)
 - FRM. *See* Financial Resource Management (FRM)
 - generic goals and practices, 950
 - HRM. *See* Human Resource Management (HRM)
 - icons, 42–43
 - IM. *See* Identity Management (IM)
 - IMC. *See* Incident Management and Control (IMC)
 - institutionalization of. *See* institutionalization
- KIM. *See* Knowledge and Information Management (KIM)
- MA. *See* Measurement and Analysis (MA)
- MON. *See* Monitoring (MON)
- numbering scheme, 47–49
- OPD. *See* Organizational Process Definition (OPD)
- OPF. *See* Organizational Process Focus (OPF)
- OTA. *See* Organizational Training and Awareness (OTA)
- PM. *See* People Management (PM)
- RISK. *See* Risk Management (RISK)
- RRD. *See* Resilience Requirements Development (RRD)
- RRM. *See* Resilience Requirements Management (RRM)
- RTSE. *See* Resilient Technical Solution Engineering (RTSE)
- SC. *See* Service Continuity (SC)
- selecting for model scope, 87–90
- supporting generic practices, 74–75
- tags, 47–49
- TM. *See* Technology Management (TM)
- typographical and structural conventions, 49–51
- VAR. *See* Vulnerability Analysis and Resolution (VAR)
- process asset library
 - collecting improvement information for communications, 208
 - defined, 977, 980
 - establishing, 613–614
- process capability, 980
- process element, 980
- process governance. *See* governance, process
- process improvement
 - appraisal of organizational processes, 632–633
 - CERT-RMM for, 77
 - CERT-RMM for model-based, 80–83
 - CERT-RMM vs. CMMI focus, 15
 - determining opportunities for, 630
 - establish organizational process needs, 631–632
 - identify improvements, 633–634
 - proposals, 641
- Process Management process areas
 - defined, 7–8
 - MA. *See* Measurement and Analysis (MA)
 - model view of, 57–59
 - MON. *See* Monitoring (MON)
 - OPD. *See* Organizational Process Definition (OPD)
 - OPF. *See* Organizational Process Focus (OPF)
 - overview of, 42–43

process maturity, 978
 process performance, 980
 processes
 defined, 980
 definition of. *See* Organizational Process Definition (OPD)
 focus of. *See* Organizational Process Focus (OPF)
 production environment, use of CERT-RMM in, 14
 profiles, identity
 assigning roles to identities, 454
 correcting inconsistencies in, 458–459
 deprovisioning, 459–460
 establishing, 450–451
 establishing identity community from, 452–453
 plan process for, 462–463
 protection, of information assets
 controls for, 519–521
 overview of, 518–519
 resilience requirements, 519
 protection, of technology assets
 controls for, 876–878
 overview of, 874–875
 resilience requirements, 875–876
 protection strategy
 for assets, 35–36
 defined, 981
 resilience requirements as basis of, 35
 protocols, communication, 491
 provide resources, generic goals and practices. *See* resources, providing
 provisioning
 defined, 981
 establishing identities and, 447
 proximity, 981
 public infrastructure, 981
 public services
 defined, 981
 managing dependencies on, 287
 purchase orders, with external entities, 360–362
 purchase requests, funding resilience activities, 391
 purpose statements
 for process areas, 44, 48
 typographical and structural conventions, 50

Q

quality attributes, in software and system development, 793–794
 questionnaires, for assessing effectiveness of awareness program, 662

R

reassignment, of roles and responsibilities, 429
 records
 of awareness activities, 661–662
 identify vital organizational, 837–839
 of maintenance operations, 895
 of monitoring information, 591–592
 of training activities, 669–670
 recovery plans, service continuity and, 839
 recovery point objectives (RPOs)
 availability of technology assets and, 892–893
 defined, 981
 recovery time objectives (RTOs)
 availability of technology assets and, 892–893
 defined, 981
 redundancy
 availability of technology assets and, 891
 establish for vital staff, 694–695
 succession planning and, 695–697
 reference resources, for information in this book, 993–995
 references, process area
 defined, 47–48
 typographical and structural conventions, 51
 registration, of identities, 450–451
 regulations
 defined, 981
 documenting events and, 481–482
 electric power industry and, 101–103
 establish scope of improvement, 84
 managing. *See* Compliance (COMP)
 stress of managing operational risk, 23
 related process areas section, 45, 48
 relationships
 establish enterprise specifications, 353–354
 establish formal agreements, 360–362
 establish resilience specifications, 355–357
 evaluate/select external entities, 358–359
 identify internal and external dependencies and interdependencies, 837
 model view. *See* model view
 objective view. *See* objective views, for assets
 overview of, 53–54, 352–353
 between process elements, 610
 release builds, 981
 release management
 defined, 981
 technical solutions released into production, 812–813
 for technology assets, 889–890
 reliability
 of information assets, 529–530
 resilience and, 100–101
 remediation
 of areas of non-compliance, 223–225
 identifying areas needing compliance, 223
 repeatability, of measures, 557
 reports
 on communications effectiveness, 194
 on compliance obligation satisfaction, 222–223
 on corrective actions, 326
 on event status, 483
 external dependencies management, 362
 in incident management, 478–479, 486
 on incident status, 491
 logged events and, 481
 post-incident review, 494
 on resilience oversight, 325
 repositories
 for compliance data, 220–221
 identity repository, 452, 974
 for processes and work products, 955
 for skills, 985
 for vulnerability information, 922–923, 925, 987
 required components
 defined, 981
 overview of, 43–44
 summary of, 48
 requirements
 guidelines for Resilient Technical Solution Engineering, 800–801
 validate service continuity plans against, 845–846
 requirements, for Monitoring
 analyze and prioritize, 585–587
 establishing, 583–585
 requirements, resilience
 developing. *See* Resilience Requirements Development (RRD)
 managing. *See* Resilience Requirements Management (RRM)
 operational. *See* operational resilience requirements
 Requirements Development, CMMI process area, 795
 residual risk, 981

resilience

- configuration management and, 884–885
- defined, 981, xv
- establish resilience-focused
 - technology assets, 873–874
- identifying vital resilience functions of staff, 689
- inserting obligations in job descriptions, 423
- management. *See* operational resilience management
- reliability and resilience in, 100–101
- requirements. *See* operational resilience requirements
- resilience-aware culture, 319–320
- resilience-focused assets, 275
- scope, 89–90
- of service, 14
- staff and training, 982
- using goals and objectives to support, 423–424

resilience budgets

- defined, 982
- establishing, 388–389
- funding resilience activities, 391
- resolving funding gaps, 388–389

Resilience Requirements Development (RRD)

- achieve specific goals, 756
- analyze resilience requirements, 755
- assign enterprise resilience requirements to services, 753–754
- assign responsibility for, 760–761
- Cloud Computing and, 962
- collect improvement information, 769
- define required functionality, 754–755
- defined, 982
- develop service requirements, 752
- developing resilient software across life cycle with, 107
- as Engineering process area, 56
- establish asset resilience requirements, 752–753
- establish defined process for, 768–769
- establish process governance, 757–758
- for facility asset resilience requirements, 276–277
- FISMA compliance, 960
- identify and involve relevant stakeholders, 763–764
- identify enterprise requirements, 750–752
- introductory notes, 747–750
- manage work product configurations, 763

monitor and control process of, 765–766

- objectively evaluate adherence, 767
- plan the process, 758–759
- provide resources for, 759–760
- purpose of, 747
- related process areas, 750
- review status with higher-level managers, 768
- summary of specific goals and practices, 750
- train people for, 761–763
- validate resilience requirements, 756

Resilience Requirements Management (RRM)

- achieve specific goals, 778
- assign responsibility for, 782–783
- Cloud Computing and, 962
- collect improvement information, 791–792
- defined, 982
- developing resilient software across life cycle, 107
- as Engineering process area, 56
- establish defined process for, 791
- establish process governance, 779–780
- identify and involve relevant stakeholders, 786–787
- identify inconsistencies in meeting resilience requirements, 778
- introductory notes, 771–772
- maintain traceability of resilience requirements, 776–777
- manage changes to resilience requirements, 775–776
- manage work product configurations, 785–786
- managing change to resilience requirements, 131
- monitor and control the process, 787–789
- objectively evaluate adherence, 789–790
- obtain commitment to resilience requirements, 774–775
- plan the process, 780–781
- provide resources for, 781–782
- purpose of, 771
- related process areas, 772
- review status with higher-level managers, 790–791
- summary of specific goals and practices, 772
- train people for, 783–785
- understanding resilience requirements, 773–774
- resilience specifications
 - defined, 982
 - evaluating/selecting external entities based on, 358–359

for external dependencies, 355–357

- external dependencies management, 361
- resilience training
 - delivery of, 668–669
 - establish training needs, 664–665
 - establish training plan, 665
 - materials, 666–667

Resilient Technical Solution

- Engineering (RTSE)
 - achieve specific goals, 813
 - assign responsibility for, 818–819
 - collect improvement information, 828–829
 - create development plans for resilient technical solutions, 807–808
- defined, 982
- developing resilient software across life cycle, 106–107
- as Engineering process area, 56
- establish defined process for, 827–828
- establish process governance, 814–815
- identify and involve relevant stakeholders, 822–823
- identify architecture and design guidelines, 801–802
- identify assembly and integration guidelines, 805–807
- identify general guidelines, 798–800
- identify implementation guidelines, 802–805
- identify requirements guidelines, 800–801
- influenced by CMMI process areas, 108
- integrating selected guidelines with software and system development process, 809–810
- introductory notes, 793–796
- manage work product configurations, 821–822
- monitor and control the process, 823–826
- monitoring execution of development plan, 810–812
- objectively evaluate adherence, 826–827
- plan the process, 816
- provide resources for, 816–818
- purpose of, 793
- related process areas, 796
- release solutions into production, 812–813
- review status with higher-level managers, 827
- select and tailor guidelines, 808–809

- summary of specific goals and practices, 796
- train people for, 820–821
- resource needs, establishing
 - address skill deficiencies, 416–418
 - establish baseline competencies, 414–415
 - inventory skills and identify gaps, 415–416
 - overview of, 413
- resources, providing. *See also* Financial Resource Management (FRM)
 - Access Management, 163–165
 - Asset Definition and Management, 137–138
 - Communications, 197
 - Compliance, 213, 229–231
 - Controls Management, 259–260
 - Enterprise Focus, 328–330
 - Environmental Control, 293–295
 - External Dependencies Management, 368–370
 - Financial Resource Management, 400–402
 - generic goals and practices, 948
 - Human Resource Management, 436–437
 - Identity Management, 462–464
 - Incident Management and Control, 499–500
 - Knowledge and Information Management, 536–538
 - Measurement and Analysis, 567–569
 - Monitoring, 596–597
 - Organizational Process Definition, 619–620
 - Organizational Process Focus, 643–645
 - Organizational Training and Awareness, 674–675
 - People Management, 704–706
 - Resilience Requirements Development, 759–760
 - Resilience Requirements Management, 781–782
 - Resilient Technical Solution Engineering, 816–818
 - Risk Management, 736–737
 - Service Continuity, 856–857
 - Technology Management, 902–904
 - Vulnerability Analysis and Resolution, 931–932
- responding to incidents
 - declare events for response planning, 483–484
 - limiting organizational impact of incidents, 488–490
 - recovery and, 487
- response and recovery, responding to incidents, 487
- responsibilities. *See also* roles
 - incident management plan and, 477–478
 - linking to identity. *See* Identity Management (IM)
 - in organizational identity, 448
 - periodic review to identify invalid identities, 457
 - roles vs., 453
- responsibilities, assigning
 - Access Management, 165–166
 - Asset Definition and Management, 138–139
 - Communications, 199–200
 - Compliance, 231–232
 - Controls Management, 261–262
 - Enterprise Focus, 330–331
 - Environmental Control, 296–297
 - External Dependencies Management, 370–371
 - Financial Resource Management, 402–403
 - generic goals and practices, 948–949
 - Human Resource Management, 437–438
 - Identity Management, 464–465
 - Incident Management and Control, 501–502
 - Knowledge and Information Management, 538–539
 - managing changes to employment status, 429
 - Measurement and Analysis, 569–570
 - Monitoring, 597–598
 - Organizational Process Definition, 620–621
 - Organizational Process Focus, 645–646
 - Organizational Training and Awareness, 676–677
 - People Management (PM), 706–707
 - Resilience Requirements Development, 760–761
 - Resilience Requirements Management, 782–783
 - Resilient Technical Solution Engineering, 818–819
 - Risk Management, 737–738
 - Service Continuity, 857–858
 - Technology Management, 904–905
 - Vulnerability Analysis and Resolution, 933
- restoration plans
 - incident response and, 489
 - service continuity and, 839
- restrictions. *See* access privileges
- retention, of information assets, 531–532
- retirement, develop plan for facility, 289–290
- retrieval, of compliance data, 220
- return on resilience investment (RORI) calculation, 396–397
 - defined, 983
- review status with higher-level managers, generic goals and practices, 953
- reviews
 - with high-level managers. *See* higher-level managers, reviewing with
 - monitoring and controlling and, 952
 - of monitoring processes, 602–603
 - in objective evaluation of adherence, 953
 - periodic of environmental control process, 302
 - periodic of identities, 456–457
 - post-execution review of service continuity plans, 851
 - sources of vulnerability, 921
- revision history, in change management, 888
- RISK. *See* Risk Management (RISK)
- risk
 - assessing controls for, 253, 257
 - assessment of facility asset, 280–281
 - availability of technology assets and, 892
 - controlling operational environment, 282–283
 - defined, 983
 - defining controls for, 248–250
 - due to external dependencies, 349–350
 - governance, xvi
 - identifying and assessing external, 350–351
 - identifying related to involuntary terminations, 432
 - mitigation strategies for external dependencies, 352
 - mitigation strategies for facility assets, 281–282
 - of non-compliance, 222
 - protecting information assets and, 518–519
 - service continuity planning and, 832
- risk analysis, 983
- risk appetite, 983
- risk category, 983
- risk disposition
 - assigning, 727–729
 - defined, 983
- risk management
 - focus on high-value services, 836
 - incident management and, 475
 - interoperability and, 898–899
- risk management, for information assets
 - identify and assess risks, 522
 - mitigate risks, 523

risk management, for information assets (*contd.*)
 overview of, 521
 prioritization and, 515–517

risk management, for technology assets
 identify and assess risks, 879–880
 mitigate risks, 880–881
 overview of, 878–879
 prioritization of technology assets, 871

risk management, of staff risk
 identify and assess staff risks, 691–692
 mitigate staff risks, 692–693
 overview of, 691

Risk Management (RISK)
 achieve specific goals, 733
 apply risk information to operational resilience management, 731–732
 assign responsibility for, 737–738
 assign risk disposition, 727–729
 categorize and prioritize risks, 727
 Cloud Computing and, 962
 collect improvement information, 745–746
 define risk parameters, 721–722
 defined, 983
 determine sources and categories of risk, 719–720
 develop risk mitigation plans, 729–731
 Enterprise Management, 54–55
 establish defined process for, 744–745
 establish operational risk management strategy, 720–721
 establish process governance, 734–735
 establish relationship between assets and services, 130
 establish risk measurement criteria, 722–723
 evaluate risks, 726–727
 FISMA compliance, 960
 identify and involve relevant stakeholders, 740–741
 identify asset-level risks, 723–725
 identify service-level risks, 725–726
 implement risk strategies, 731
 insider threats and, 964
 introductory notes, 717–718
 manage work product configurations, 740
 mitigate risks, 729
 monitor and control the process, 741–743
 objectively evaluate adherence, 743–744
 plan the process, 735
 preparing for, 719
 provide resources for, 736–737

purpose of, 717
 related process areas, 718
 relationships driving threat/incident management, 58
 review and adjust risk-related strategies, 732–733
 review status with higher-level managers, 744
 summary of specific goals and practices, 718
 train people for, 738–739

risk measurement criteria, 983

risk mitigation
 defined, 983
 for external dependencies, 352
 for facility assets, 281–282
 of general risks, 729
 implementing process action plans, 731
 risk mitigation plans, 729–731, 983
 of staff risks, 692–693
 of technology asset risks, 880–881

risk parameters, 984

risk statements
 defined, 984
 developing, 725
 staff risks and, 692

risk taxonomy, 984

risk threshold, 984

risk tolerance
 defined, 984
 overview of, 721–722
 vulnerability analysis and resolution strategy and, 918–919

roles. *See also* responsibilities
 access privileges and, 155–156
 assign for knowledge and information management, 539
 assign to identities, 453–454
 identifying vital staff and, 688
 incident management plan and, 477–478
 linking to organizational identity. *See* Identity Management (IM)
 managing changes to employment status, 429
 organizational process definition process, 621
 periodic review to identify invalid identities, 457

root-cause analysis
 applying to vulnerabilities, 927–928
 defined, 984
 in post-incident review, 494

RORI (return on resilience investment)
 calculation, 396–397
 defined, 983

RPOs (recovery point objectives)
 availability of technology assets and, 892–893
 defined, 981

RRD. *See* Resilience Requirements Development (RRD)

RRM. *See* Resilience Requirements Management (RRM)

RTOs (recovery time objectives)
 availability of technology assets and, 892–893
 defined, 981

RTSE. *See* Resilient Technical Solution Engineering (RTSE)

rules, establish for integrated teams, 615–616

S

safety, work environment standards, 615

SC. *See* Service Continuity (SC)

scalability, of CERT-RMM, 15

SCAMPI (Standard CMMI Appraisal Method for Process Improvement), 92

scope
 of assets and environments, 917–918
 basing improvement objectives on, 84–85
 capability appraisal and, 93–94
 CERT-RMM, 14
 of control assessment, 255–256
 defined, 984
 model scope, 87–90, 976
 organizational scope, 84–87, 978
 of risk assessment, 281
 RORI calculation, 396–397

scorecard, governance, 324

screening, pre-employment, 418–419

secure design pattern, 984

security
 benefits of CERT-RMM, 5
 evolution of CERT-RMM, 10–11
 protection of information assets, 518–519
 protection of technology assets, 874–875
 protection strategy, 35–36
 service continuity plans, 843–844
 work environment standards, 615

SEI (Software Engineering Institute), 8, 9–12

sensitivity
 asset disposal and, 526
 attributes of information assets, 514
 categorize information assets by, 517–518
 defined, 984
 identifying staff responsible for sensitive assets, 690
 organizational sensitivity, 978

service continuity plans
 assign staff to, 842–843
 availability of technology assets and, 891–893

- defined, 985
- develop and document, 840–842
- develop testing program and standards for, 847–848
- develop training for, 844
- establish change criteria for, 852
- evaluate test results, 849–850
- execute, 850–851
- exercise tests of, 849
- identify and resolve conflicts in, 846
- identify required plans, 840
- identify vital staff, 688
- maintain, 851–853
- measure effectiveness of, 851
- prepare for staff redeployment, 697–698
- return-to-work plan, 700
- risk mitigation and, 733
- store and secure, 843–844
- support of staff during disruptive events, 699
- technology assets in, 873
- validation of, 845–846
- Service Continuity (SC)
 - achieve specific goals, 853
 - assign responsibility for, 857–858
 - assign staff to plans, 842–843
 - Cloud Computing and, 963
 - collect improvement information, 866–867
 - controls management using, 243
 - defined, 984
 - develop and document plans, 840–842
 - develop and document test plans, 848
 - develop operational resilience management plan, 315–316
 - develop resilient software across life cycle with, 108
 - develop testing program and standards, 847–848
 - develop training, 844
 - as Engineering process area, 56
 - establish change criteria, 852
 - establish defined process for, 865–866
 - establish process governance, 853–855
 - establish resilience-focused facility assets, 275
 - establish standards and guidelines for, 835
 - evaluate test results, 849–850
 - execute plans, 850–851
 - FISMA compliance, 960
 - identify and involve relevant stakeholders, 860–862
 - identify and resolve conflicts in plans, 846
 - identify communications requirements with, 180–181
 - identify high-value services, 835–836
 - identify internal and external dependencies and interdependencies, 837
 - identify required plans, 840
 - identify vital organizational records and databases, 837–839
 - incident response and, 489
 - introductory notes, 831–832
 - maintain changes to plans, 852–853
 - maintain plans, 851
 - manage work product configurations, 860
 - measure effectiveness of plans, 851
 - monitor and control the process, 862–864
 - objectively evaluate adherence, 864–865
 - plan the process, 855
 - prepare and plan for, 833–835
 - protect and sustain services and assets, 131
 - provide resources for, 856–857
 - purpose of, 831
 - related process areas, 832–833
 - relationships driving threat/incident management, 58
 - review status with higher-level managers, 865
 - store and secure plans, 843–844
 - summary of specific goals and practices, 833
 - test (exercise) plans, 849
 - train people for, 858–859
 - validate plans, 845–846
- service disruption, 915
- service level agreements (SLAs), 985
- service profiles, 985
- service-level controls
 - assessing effectiveness of, 253–254
 - defining, 248–250
- service-level resilience requirements
 - analyze and validate, 754
 - assigning enterprise resilience requirements to services, 753–754
 - defined, 985
 - developing, 752
 - overview of, 748
- service-level risks
 - identifying, 725–726
 - review and adjust strategies for, 732–733
- services
 - in CERT-RMM, 14
 - CERT-RMM not establishing, delivering or managing, 14
 - concept of, 27–29
 - defined, 984
 - establish relationship between assets and, 130–131
 - focus on high-value, 29
 - fuelled by assets, 30–33
 - life-cycle of, 38–39
 - operational risk objectives, 25–27
 - prioritize external dependencies relative to, 348–349
 - prioritize information assets relative to, 516
- services map, 753
- service-support staff, 689
- shared resilience requirements, 985
- Shewhart cycle, 80
- silos, 5
- skills
 - addressing gaps and deficiencies, 416–417
 - identifying gaps and deficiencies, 416
 - incident management plan and, 477–478
 - inventory or repository, 415–416, 985
 - service continuity plans and, 844
 - training needs and, 665
- skills, training
 - Access Management, 167
 - Asset Definition and Management, 138, 140
 - Communications, 200–201
 - Compliance, 232–233
 - Controls Management, 262–263
 - Enterprise Focus, 331
 - Environmental Control, 297–298
 - External Dependencies Management, 371–372
 - Financial Resource Management, 403–404
 - generic goals and practices, 949–950
 - Human Resource Management, 439–440
 - Identity Management, 465–466
 - Incident Management and Control, 502–503
 - Knowledge and Information Management, 537, 540–541
 - Measurement and Analysis, 570–571
 - Monitoring, 599
 - Organizational Process Definition, 622
 - Organizational Process Focus, 646–647
 - Organizational Training and Awareness, 677–678
 - People Management, 708–709
 - Resilience Requirements Development, 762–763
 - Resilience Requirements Management, 784–785
 - Resilient Technical Solution Engineering, 820–821
 - Risk Management, 739
 - Service Continuity, 859

- skills, training (*contd.*)
 - Technology Management, 906
 - Vulnerability Analysis and Resolution, 934
- SLAs (service level agreements), 985
- sociopolitical events, controlling
 - operational environment, 283
- software
 - architecture and design guidelines, 801–802
 - assembly and integration
 - guidelines, 805–807
 - errors, 891
 - execution of development plan, 810–812
 - implementation guidelines, 802–805
 - integrating selected resilience
 - guidelines with development process for, 809–810
 - integrity of, 882
 - monitoring, 795
 - releasing resilient solutions into
 - production, 812–813
 - resilience guidelines, 800–801
 - resilience requirements, 793–794
 - stress of managing as intangible asset, 22
 - tailoring resilience guidelines using
 - selection criteria, 808–809
- software assurance, using CERT-RMM
 - about the authors, 104–105
 - defined, 105
 - overview of, 105–110
- Software Engineering Institute (SEI), 8, 9–12
- specific goals and practices
 - defined, 45–46, 48, 985
 - tags and numbering scheme for, 49
 - typographical and structural conventions, 50
 - using practice-level scope, 88–89
- sponsorship. *See also* managers, review with higher-level
 - commit funding for operational
 - resilience management, 383–384
 - for compliance program, 214, 231
 - establish scope of improvement, 84–85
 - of identity, 451
- sponsorship, for operational resilience management
 - commit funding, 318–319
 - overview of, 317–318
 - promote resilience-aware culture, 319–320
 - standards and policies, 320–321
- staff
 - access controls for, 883–884
 - acquisition of, 418
 - assigning to service continuity plans, 842–843
 - defined, 985
 - document organizational and intellectual knowledge of, 532–533
 - establish vital, 687–690
 - incident response and, 490
 - for maintenance operations, 894–895
 - managing. *See* People Management (PM)
 - for operational resilience management program, 316–317
 - personnel services. *See* Human Resource Management (HRM)
 - post-incident review, 494
 - providing for incident closure, 492
 - resource provision and, 948
 - training. *See* training people
 - training in discovery of vulnerabilities, 923
 - verifying suitability of candidates, 418–419
- staff, providing
 - Access Management, 163–164
 - Asset Definition and Management, 137
 - Communications, 186–188, 198–200
 - Compliance, 229–230
 - Controls Management, 260
 - Enterprise Focus, 329
 - Environmental Control, 293–294, 296–297
 - External Dependencies Management, 368–370
 - Financial Resource Management, 400–401
 - Human Resource Management, 436
 - Identity Management, 462–464
 - Incident Management and Control, 477–478, 499–500
 - Knowledge and Information Management, 537
 - Measurement and Analysis, 568
 - Monitoring, 596–597
 - Organizational Process Definition, 619–620
 - Organizational Process Focus, 644
 - Organizational Training and Awareness, 674
 - People Management, 704–705
 - Resilience Requirements Development, 759–760
 - Resilience Requirements Management, 781
 - Resilient Technical Solution Engineering, 817
 - Risk Management, 736–737
 - Service Continuity, 856
 - Technology Management, 902–903
 - Vulnerability Analysis and Resolution, 931–932
- staff availability
 - establish redundancy for vital staff, 694–695
 - managing, 693–694
 - perform succession planning, 695–697
 - plan for return-to-work following disruptive events, 700–701
 - plan to support staff during disruptive events, 698–700
 - prepare for redeployment, 697–698
- staff risks
 - identify and assess, 691–692
 - mitigate, 692–693
 - overview of, 691
- stakeholders
 - communicating measurement results to, 564–565
 - communicating to regarding incidents, 489
 - defined, 985
 - distributing collected information to, 592–593
 - escalation of incidents for input from, 487–488
 - in monitoring processes, 581–582
 - for performing resilience oversight, 324–325
- stakeholders, identify and involve
 - Access Management, 168–169
 - Asset Definition and Management, 141–142
 - Communications, 177–181, 202–203
 - Compliance, 234–236
 - Controls Management, 264–265
 - Enterprise Focus, 332–333
 - Environmental Control, 299–300
 - External Dependencies Management, 373–374
 - Financial Resource Management, 404–406
 - generic goals and practices, 951
 - Human Resource Management, 441–442
 - Identity Management, 467–468
 - Incident Management and Control, 504–506
 - Knowledge and Information Management, 542–543
 - Measurement and Analysis, 571–573
 - Monitoring, 600–601
 - Organizational Process Definition, 623–624
 - Organizational Process Focus, 648–649
 - Organizational Training and Awareness, 679–680
 - People Management, 710–711

- Resilience Requirements
 - Development, 763–764
- Resilience Requirements
 - Management, 786–787
- Resilient Technical Solution
 - Engineering, 822–823
- Risk Management, 740–741
- Service Continuity, 860–862
- Technology Management, 907–908
- Vulnerability Analysis and Resolution, 935–936
- Standard CMMI Appraisal Method for Process Improvement (SCAMPI), 92
- standard processes
 - composition of, 607
 - defined, 978, 986
 - defined processes compared with, 954
 - deploying, 638
 - establishing, 608–610
 - measurement repository for, 612
 - monitoring implementation of, 639
 - tailoring and, 611–612
- standards. *See also* guidelines
 - for communications, 181–184
 - Compliance, 214
 - for configuration management, 886
 - establishing standard processes, 608–610
 - interoperability, 898
 - managing. *See* Compliance (COMP)
 - for monitoring, 589–591
 - for service continuity, 835
 - sponsoring resilience, 320–321
 - test service continuity plans against, 847–848
 - validate service continuity plans against, 845–846
 - for work environments, 614–615
- statistics, descriptive statistics in data analysis, 560
- Stevens, James, 99–100
- storage
 - of compliance data, 220
 - of data, 563–564
 - data collection and, 557–559
 - of service continuity plans, 843–844
- strategic planning
 - defined, 986
 - developing operational resilience management plan, 314–316
 - establish critical success factors, 310–312
 - establish organizational services, 312–314
 - establish scope of improvement, 84
 - establishing, 309–310
 - funding operational resilience management, 383–384
 - performing resilience oversight for, 323–324
 - using CERT-RMM to support, 78
- strategies
 - establish operational risk management strategy, 720–721
 - establish vulnerability analysis and resolution strategy, 918–920
 - implement risk strategies, 731
 - for protecting/sustaining assets, 35–36
 - review and adjust asset-level risk strategies, 732
 - review and adjust service-level risk strategies, 732–733
 - for staff redundancy, 695
 - translating lessons into, 495–496
- strengths and weaknesses, appraisal of organization, 632–633
- stress
 - causes of in operational resilience management, 2
 - CERT-RMM control of organizational behavior during, 21–23
 - managing operational resilience, 25–27
- structural conventions, process areas, 49–51
- subpractices, process area
 - defined, 47–48
 - typographical and structural conventions, 51
- subprocesses, 986
- succession planning
 - defined, 986
 - perform, 695–697
- summary of specific goals and practices, process areas, 45
- Supplier Management, Operations, 57
- suppliers, 986
- surveys
 - assess effectiveness of awareness program, 662
 - assess effectiveness of training program, 670
- sustain
 - defined, 986
 - facility assets, 284–285
 - information, 35–36
 - services and assets, 131
 - technology assets, 891–894
- sustainability planning, 285–286
- Sustaining Operational Resiliency: A Process Improvement Approach to Security Management* (Caralli 2006), 12
- systems
 - architecture and design guidelines, 801–802
 - assembly and integration guidelines, 805–807
 - execution of development plan, 810–812
 - implementation guidelines, 802–805
 - integrating selected resilience guidelines with development process for, 809–810
 - monitoring, 795
 - releasing resilient solutions into production, 812–813
 - resilience guidelines, 800–801
 - resilience requirements, 793–794
 - tailoring resilience guidelines using selection criteria, 808–809
- T**
 - tags, process area, 47–49, 50
 - targeted improvement profile (TIP)
 - capability level ratings overlaid on, 93–94
 - overview of, 91–92
 - targeted improvement roadmaps (TIRs)
 - for achieving FISMA compliance, 957–961
 - for Cloud Computing, 961–963
 - establishing improvement objective with, 88
 - for managing insider threats, 963
 - teams, establish rules and guidelines for integration of, 615–616
 - technical controls
 - defined, 986
 - at enterprise/service/asset levels, 248–250
 - for facility assets, 277–279
 - for information assets, 519–521
 - overview of, 246–247
 - for technology assets, 876–878
 - technical solutions. *See* Resilient Technical Solution Engineering (RTSE)
 - Technical Solutions, CMMI process area, 795
 - techniques. *See* tools, techniques, and methods
 - technology. *See also* Asset Definition and Management (ADM) and Technology Management (TM)
 - access privileges focusing on, 153
 - as asset in CERT-RMM, 31–32
 - assets, 986
 - identity management and, 448–449
 - interoperability. *See* interoperability life-cycle of, 37
 - managing operational risk of, 23
 - objective views for, 60, 62
 - operational resilience management and, 2
 - protecting and sustaining, 35–36
 - resilience requirements for, 33–35
 - stress of managing operational risk of, 22
 - as traditional focus of operational risk management, 8–9

- Technology Management (TM)
 - access controls for, 882–883
 - achieve specific goals, 899
 - assign resilience requirements, 875–876
 - assign responsibility for, 904–905
 - Cloud Computing and, 962–963
 - collect improvement information, 913–914
 - defined, 986
 - developing resilient software across life cycle with, 108
 - establish and implement controls, 876–878
 - establish defined process, 912–913
 - establish process governance, 899–901
 - establish resilience-focused technology assets, 873–874
 - FISMA compliance, 961
 - identify and assess risks, 879–880
 - identify and involve relevant stakeholders, 907–908
 - introductory notes, 869–870
 - maintain technology assets, 894–895
 - manage availability of technology assets, 890–891
 - manage integrity of technology assets, 881–882
 - manage risks, 878–879
 - manage technology capacity, 895–897
 - manage technology interoperability, 897–899
 - manage work product configurations, 906–907
 - mitigate risks, 880–881
 - monitor and control, 909–911
 - objectively evaluate adherence, 911–912
 - as Operations process area, 57
 - perform change management, 887–888
 - perform configuration management, 883–887
 - perform release management, 889–890
 - plan the process for, 901–902
 - prioritize technology assets, 871–873
 - protect technology assets, 874–875
 - provide resources for, 902–904
 - purpose of, 869
 - related process areas, 870
 - review status with higher-level managers, 912
 - summary of specific goals and practices, 870–871
 - sustain technology assets, 891–894
 - train people for, 905–906
- termination, external dependencies management, 362
- termination of employment
 - involuntary, 428
 - managing impact of position changes, 428–429
 - managing involuntary, 431–432
 - voluntary, 427
- terms and conditions of employment, establishing, 420–422
- test (exercise) service continuity plans
 - develop and document tests, 848
 - develop testing program and standards, 847–848
 - evaluate test results, 849–850
 - exercise tests, 849
- tests
 - guidelines for resilient software and systems, 803–805
 - release management and, 889–890
- Threat, Vulnerability and Incident Management, Operations, 57
- threat actor, 987
- threat motive, 987
- threats. *See also* vulnerabilities
 - defined, 986
 - manage insider threats, 963
 - monitoring software and systems for, 795
 - protecting information assets, 518–519
- TIP (targeted improvement profile)
 - capability level ratings overlaid on, 93–94
 - overview of, 91–92
- TIRs. *See* targeted improvement roadmaps (TIRs)
- TM. *See* Technology Management (TM)
- tools, techniques, and methods
 - Access Management, 164
 - Asset Definition and Management, 138
 - Communications, 199
 - Compliance, 230
 - Controls Management, 260–261
 - Enterprise Focus, 329–330
 - Environmental Control, 294–295
 - External Dependencies Management, 370
 - Financial Resource Management, 401–402
 - Human Resource Management, 437
 - Identity Management, 463–464
 - Incident Management and Control, 500
 - Knowledge and Information Management, 538
 - Measurement and Analysis, 568–569
 - for monitoring process, 597
 - Organizational Process Definition, 620
 - Organizational Process Focus, 644
- Organizational Training and Awareness, 675
- People Management, 705–706
- Resilience Requirements Development, 760
- Resilience Requirements Management, 782
- Resilient Technical Solution Engineering, 817–818
- Risk Management, 737
- Service Continuity, 857
- Technology Management, 903
- Vulnerability Analysis and Resolution, 932
- traceability, of resilience requirements, 776–777
- tracking
 - events in incident management, 480–481
 - resilience requirements, 777
- training people
 - Access Management, 167
 - Asset Definition and Management, 138, 140
 - Communications, 200–201
 - Compliance, 232–233
 - Controls Management, 262–263
 - Enterprise Focus, 331
 - Environmental Control, 297–298
 - External Dependencies Management, 371–372
 - Financial Resource Management, 403–404
 - generic goals and practices, 949–950
 - Human Resource Management, 439–440
 - Identity Management, 465–466
 - Incident Management and Control, 502–503
 - Knowledge and Information Management, 540–541
 - Measurement and Analysis, 570–571
 - Monitoring, 598–599
 - Organizational Process Definition, 621–623
 - Organizational Process Focus, 646–647
 - Organizational Training and Awareness, 677–678
 - People Management, 707–709
 - Resilience Requirements Development, 761–763
 - Resilience Requirements Management, 783–785
 - Resilient Technical Solution Engineering, 820–821
 - Risk Management, 738–739
 - Service Continuity, 844, 858–859
 - Technology Management, 905–906
 - Vulnerability Analysis and Resolution, 934

training programs. *See also*
 Organizational Training and
 Awareness (OTA)
 assess effectiveness of, 670–671
 conduct, 668
 deliver resilience training, 668–669
 establish capability for, 666–668
 establish needs, 664–665
 establish plan, 665–666
 record, 669–670
 triaging events, in incident
 management, 482–483
 trusted access. *See* Identity
 Management (IM)
 typical work products, process areas
 defined, 46–48
 typographical and structural
 conventions, 51
 typographical conventions, 49–51

U

unplanned downtime, 890, 987
 updating
 measurement and analysis
 objectives, 559
 process definitions and
 development plans, 810
 service continuity plans, 846
 vulnerability repository, 925
 user IDs, access control via, 525
 users, 987
 utility sector, CERT-RMM in
 about the authors, 99–100
 grid modernization and
 transformation, 103–104
 regulation and peer pressure,
 101–103
 reliability and resilience in, 100–101

V

validation
 of compliance data, 221
 of resilience requirements, 756
 of service continuity plans, 845–846
 validity and reliability, of information
 assets, 529–530
 VAR. *See* Vulnerability Analysis and
 Resolution (VAR)
 verification
 evaluating suitability of candidate
 staff, 418–420
 managing access to assets during
 position changes, 430–431
 version control, manage work product
 configurations and, 950
 vital records
 defined, 987
 protecting, 513
 vital resilience functions, 689
 vital staff. *See also* staff, 987
 voluntary termination, of employment,
 427
 vulnerabilities
 analysis and resolution strategy for,
 918–920
 analyze, 923–925
 defined, 987
 discover, 921–923
 establish scope of, 917–918
 identify root causes, 927–928
 identify sources of, 920–921
 manage exposure to, 925–927
 monitoring software and systems
 for, 795
 overview of, 915–916
 protecting information assets,
 518–519
 service continuity planning and, 832
 Vulnerability Analysis and Resolution
 (VAR)
 achieve specific goals, 928
 analyze vulnerabilities, 923–925
 assign responsibility for, 933
 collect improvement information,
 940–941
 defined, 987
 discover vulnerabilities, 921–923
 establish analysis and resolution
 strategy, 918–920
 establish defined process, 940
 establish process governance,
 929–930
 establish scope of assets and
 environments to be analyzed,
 917–918
 FISMA compliance, 961
 identify and involve relevant
 stakeholders, 935–936
 identify root causes, 927–928
 identify sources of vulnerabilities,
 920–921
 insider threats and, 964
 introductory notes, 915–916
 manage exposure to vulnerabilities,
 925–927
 manage work product
 configurations, 935
 monitor and control the process,
 937–939
 monitoring needs of, 586
 objectively evaluate adherence,
 939
 plan the process, 930–931
 prepare for vulnerability analysis
 and resolution, 917
 provide resources for, 931–932
 purpose of, 915
 related process areas, 916
 relationships driving threat/incident
 management, 57–58

review status with higher-level
 managers, 940
 summary of specific goals and
 practices, 916
 train people for, 934
 vulnerability catalogs, 921
 vulnerability data collection, 921
 vulnerability management strategy, 987
 vulnerability notification services, 921
 vulnerability repository, 987
 vulnerability resolution, 987

W

waivers, 987
 White, David W., 999, xxiv
 work environment standards, 614–615
 work product configurations
 Access Management, 168
 Asset Definition and Management,
 141
 Communications, 202
 Compliance, 234
 Controls Management, 264
 Enterprise Focus, 332
 Environmental Control, 298–299
 External Dependencies
 Management, 373
 generic goals and practices, 950
 Human Resource Management,
 440–441
 Identity Management, 466–467
 Incident Management and Control,
 504
 Knowledge and Information
 Management, 541
 Measurement and Analysis, 571
 Monitoring, 599–600
 Organizational Process Definition,
 623
 Organizational Process Focus,
 647–648
 Organizational Training and
 Awareness, 678–679
 People Management, 709
 Resilience Requirements
 Development, 763
 Resilience Requirements
 Management, 785–786
 Resilient Technical Solution
 Engineering, 821–822
 Risk Management, 740
 Service Continuity, 860
 Technology Management,
 906–907
 Vulnerability Analysis and
 Resolution, 935
 work products, typical
 defined, 46–48
 typographical and structural
 conventions, 51