

BLM5102

Computer Systems and Network Security

Prof. Dr. Hasan Hüseyin BALIK

(3rd Week)

Outline

- 2. Management issues
 - 2.1. IT Security Management and Risk Assessment
 - 2.2. IT Security Controls, Plans and Procedures
 - 2.3. Physical and Infrastructure Security
 - 2.4. Human Resources Security
 - 2.5. Security Auditing
 - 2.6. Legal and Ethical Aspects

2.2. IT Security Controls, Plans, and Procedures

2.2. Outline

- IT Security Management Implementation
- Security Controls or Safeguards
- IT Security Plan
- Implementation of Controls
- Monitoring Risks
- Case Study: Silver Star Mines

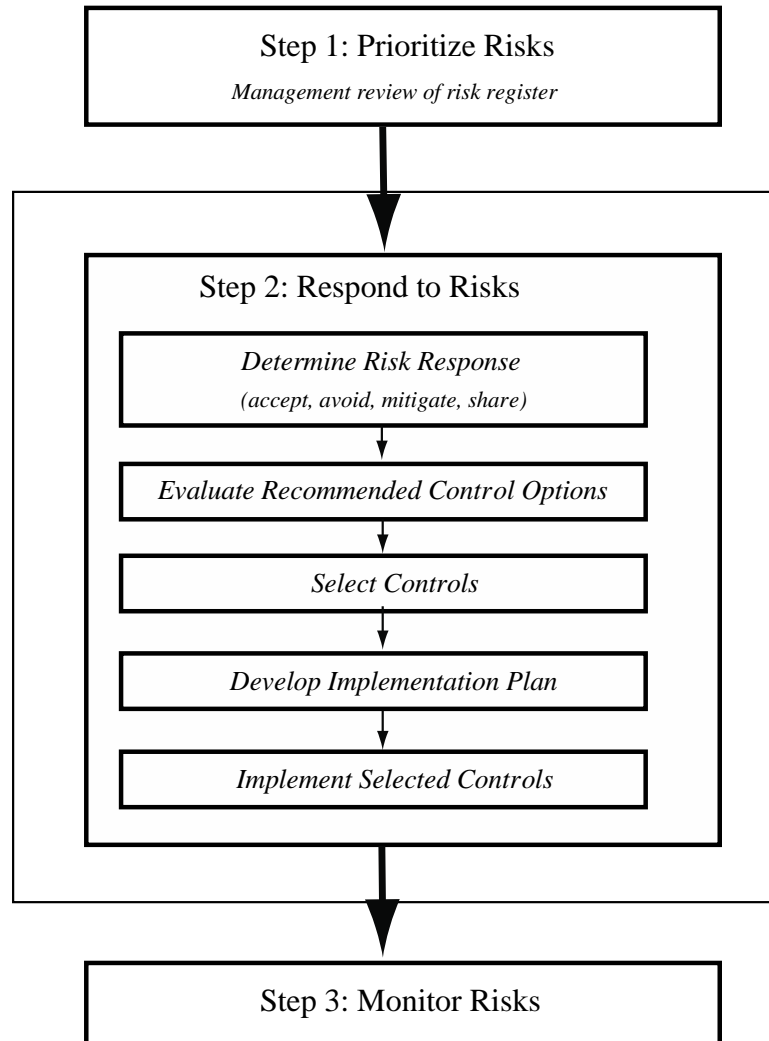


Figure 15.1 IT Security Management Controls and Implementation

Security Control

Control is defined as:

“An action, device, procedure, or other measure that reduces risk by eliminating or preventing a security violation, by minimizing the harm it can cause, or by discovering and reporting it to enable corrective action.”

Control Classifications

- Management controls
 - Focus on security policies, planning, guidelines, and standards that influence the selection of operational and technical controls to reduce the risk of loss and to protect the organization's mission
 - These controls refer to issues that management needs to address
- Operational controls
 - Address the correct implementation and use of security policies and standards, ensuring consistency in security operations and correcting identified operational deficiencies
 - These controls relate to mechanisms and procedures that are primarily implemented by people rather than systems
 - They are used to improve the security of a system or group of systems
- Technical controls
 - Involve the correct use of hardware and software security capabilities in systems
 - These range from simple to complex measures that work together to secure critical and sensitive data, information, and IT systems functions

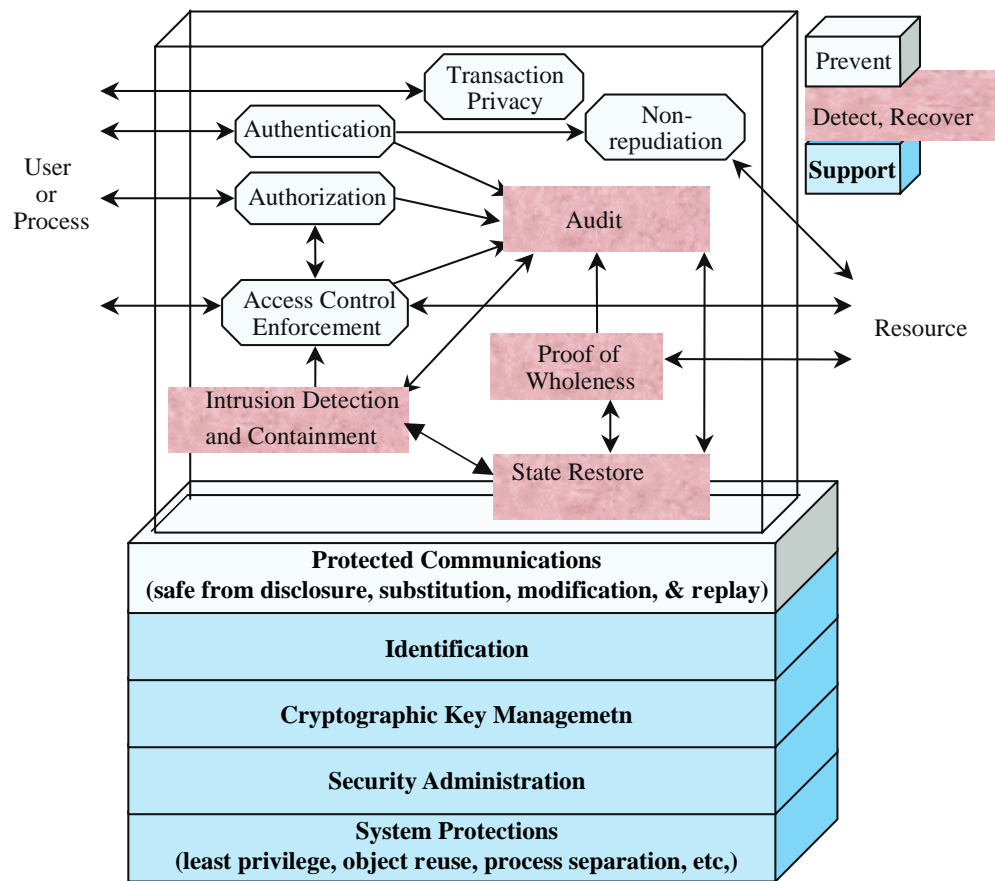


Figure 15.2 Technical Security Controls

Control Classes

Each of the control classes may include the following:

- Supportive controls
 - Pervasive, generic, underlying technical IT security capabilities that are interrelated with, and used by, many other controls
- Preventative controls
 - Focus on preventing security breaches from occurring, by inhibiting attempts to violate security policies or exploit a vulnerability
- Detection and recovery controls
 - Focus on the response to a security breach, by warning of violations or attempted violations of security policies or the identified exploit of a vulnerability and by providing means to restore the resulting lost computing resources

NIST SP800-53 Security Controls

| CLASS | CONTROL FAMILY |
|--------------|---------------------------------------|
| Management | Planning |
| Management | Program Management |
| Management | Risk Assessment |
| Management | Security Assessment and Authorization |
| Management | System and Services Acquisition |
| Operational | Awareness and Training |
| Operational | Configuration Management |
| Operational | Contingency Planning |
| Operational | Incident Response |
| Operational | Maintenance |
| Operational | Media Protection |
| Operational | Personnel Security |
| Operational | Physical and Environmental Protection |
| Operational | System and Information Integrity |
| Technical | Access Control |
| Technical | Audit and Accountability |
| Technical | Identification and Authentication |
| Technical | System and Communications Protection |

Security Policies Ensure that information security policies support business requirements and comply with relevant laws and regulations.

Organization of Information Security Provide a management framework for controlling the implementation of security policies, and ensuring security of mobile devices.

Human Resource Security Ensure that employees and contractors understand and comply with security policies. Protect the organization's interests during the process of terminating or changing employment.

Asset Management Identify assets to be protected and define appropriate responsibilities for managing assets. prevent unauthorized disclosure, modification, removal or destruction of information stored on media.

Access Control Define access privileges for access to information and information processing facilities. Ensure authorized user access and prevent unauthorized user access. Hold users accountable for safeguarding their authentication information.

Cryptography Ensure proper and effective use of cryptographic software and hardware so as to provide confidentiality, integrity, and authenticity services.

Physical and Environmental Security Define and implement policies to secure information processing facilities and to manage physical access to secure locations and secured facilities. Prevent loss, damage, theft or compromise of assets and interruption to the organization's operations.

Operations Security Ensure that the operation of information processing facilities conforms to security policies. Measures include ensuring that information and information processing facilities are protected against malware; protecting against loss of data; recording events and generate evidence; ensuring the integrity of operational systems to prevent exploitation of technical vulnerabilities.

Communications Security Implement security policies to protect network equipment and facilities, and to protect information transferred within an organization and with an external entity.

System acquisition, development and maintenance Ensure that security policies and procedures apply throughout a system's lifetime.

Supplier relationships Ensure that agreements with suppliers meet security policy requirements. Monitor and assess compliance with security agreements.

Information security incident management Implement an incident management capability that enables management of information security incidents, including reporting and documenting incidents and responses.

Information security continuity Ensure that security policies address requirements for incorporation into the organization's business continuity management systems.

Compliance Ensure that legal, statutory, regulatory or contractual obligations related to information security are met. Ensure that systems and personnel comply with the organization's security policies.

ISO/IEC 27002

Security Controls

Access Control

Access Control Policy and Procedures, Account Management, Access Enforcement, Information Flow Enforcement, Separation of Duties, Least Privilege, Unsuccessful Login Attempts, System Use Notification, Previous Logon (Access) Notification, Concurrent Session Control, Session Lock, Permitted Actions without Identification or Authentication, Security Attributes, Remote Access, Wireless Access, Access Control for Mobile Devices, Use of External Information Systems, User-Based Collaboration and Information Sharing, Publicly Accessible Content

Awareness and Training

Security Awareness and Training Policy and Procedures, Security Awareness, Security Training, Security Training Records, Contacts with Security Groups and Associations

Audit and Accountability

Audit and Accountability Policy and Procedures, Auditable Events, Content of Audit Records, Audit Storage Capacity, Response to Audit Processing Failures, Audit Review, Analysis, and Reporting, Audit Reduction and Report Generation, Time Stamps, Protection of Audit Information, Non-repudiation, Audit Record Retention, Audit Generation, Monitoring for Information Disclosure, Session Audit

Security Assessment and Authorization

Security Assessment and Authorization Policies and Procedures, Security Assessments, Information System Connections, Plan of Action and Milestones, Security Accreditation, Continuous Monitoring

Configuration Management

Configuration Management Policy and Procedures, Baseline Configuration, Configuration Change Control, Security Impact Analysis, Access Restrictions for Change, Configuration Settings, Least Functionality, Information System Component Inventory, Configuration Management Plan

Contingency Planning

Contingency Planning Policy and Procedures, Contingency Plan, Contingency Training, Contingency Plan Testing and Exercises, Alternate Storage Site, Alternate Processing Site, Telecommunications Services, Information System Backup, Information System Recovery and Reconstitution

Identification and Authentication

Identification and Authentication Policy and Procedures, Identification and Authentication (Organizational Users), Device Identification and Authentication, Identifier Management, Authenticator Management, Authenticator Feedback, Cryptographic Module Authentication, Identification and Authentication (Non- Organizational Users)

Incident Response

Incident Response Policy and Procedures, Incident Response Training, Incident Response Testing and Exercises, Incident Handling, Incident Monitoring, Incident Reporting, Incident Response Assistance, Incident Response Plan

Maintenance

System Maintenance Policy and Procedures, Controlled Maintenance, Maintenance Tools, Non-Local Maintenance, Maintenance Personnel, Timely Maintenance

Media Protection

Media Protection Policy and Procedures, Media Access, Media Marking, Media Storage, Media Transport, Media Sanitization

Physical and Environmental Protection

Physical and Environmental Protection Policy and Procedures, Physical Access Authorizations, Physical Access Control, Access Control for Transmission Medium, Access Control for Output Devices, Monitoring Physical Access, Visitor Control, Access Records, Power Equipment and Power Cabling, Emergency Shutoff, Emergency Power, Emergency Lighting, Fire Protection, Temperature and Humidity Controls, Water Damage Protection, Delivery and Removal, Alternate Work Site, Location of Information System Components, Information Leakage

Detailed NIST SP800-53 Security Controls

Planning

Security Planning Policy and Procedures, System Security Plan, Rules of Behavior, Privacy Impact Assessment, Security-Related Activity Planning

Personnel Security

Personnel Security Policy and Procedures, Position Categorization, Personnel Screening, Personnel Termination, Personnel Transfer, Access Agreements, Third-Party Personnel Security, Personnel Sanctions

Risk Assessment

Risk Assessment Policy and Procedures, Security Categorization, Risk Assessment, Vulnerability Scanning

System and Services Acquisition

System and Services Acquisition Policy and Procedures, Allocation of Resources, Life Cycle Support, Acquisitions, Information System Documentation, Software Usage Restrictions, User Installed Software, Security Engineering Principles, External Information System Services, Developer Configuration Management, Developer Security Testing, Supply Chain Protection, Trustworthiness, Critical Information System Components

System and Communications Protection

System and Communications Protection Policy and Procedures, Application Partitioning, Security Function Isolation, Information in Shared Resources, Denial of Service Protection, Resource Priority, Boundary Protection, Transmission Integrity, Transmission Confidentiality, Network Disconnect, Trusted Path, Cryptographic Key Establishment and Management, Use of Cryptography, Public Access Protections, Collaborative Computing Devices, Transmission of Security Attributes, Public Key Infrastructure Certificates, Mobile Code, Voice Over Internet Protocol, Secure Name /Address Resolution Service (Recursive or Caching Resolver), Architecture and Provisioning for Name/Address Resolution Service, Session Authenticity, Fail in Known State, Thin Nodes, Honeypots, Operating System-Independent Applications, Protection of Information at Rest, Heterogeneity, Virtualization Techniques, Covert Channel Analysis, Information System Partitioning, Transmission Preparation Integrity, Non-Modifiable Executable Programs

System and Information Integrity

System and Information Integrity Policy and Procedures, Flaw Remediation, Malicious Code Protection, Information System Monitoring, Security Alerts Advisories and Directives, Security Functionality Verification, Software and Information Integrity, Spam Protection, Information Input Restrictions, Information Input Validation, Error Handling, Information Output Handling and Retention, Predictable Failure Prevention

Program Management

Information Security Program Plan, Senior Information Security Officer, Information Security Resources, Plan of Action and Milestones Process, Information System Inventory, Information Security Measures of Performance, Enterprise Architecture, Critical Infrastructure Plan, Risk Management Strategy, Security Authorization Process, Mission/Business Process Definition

Continued

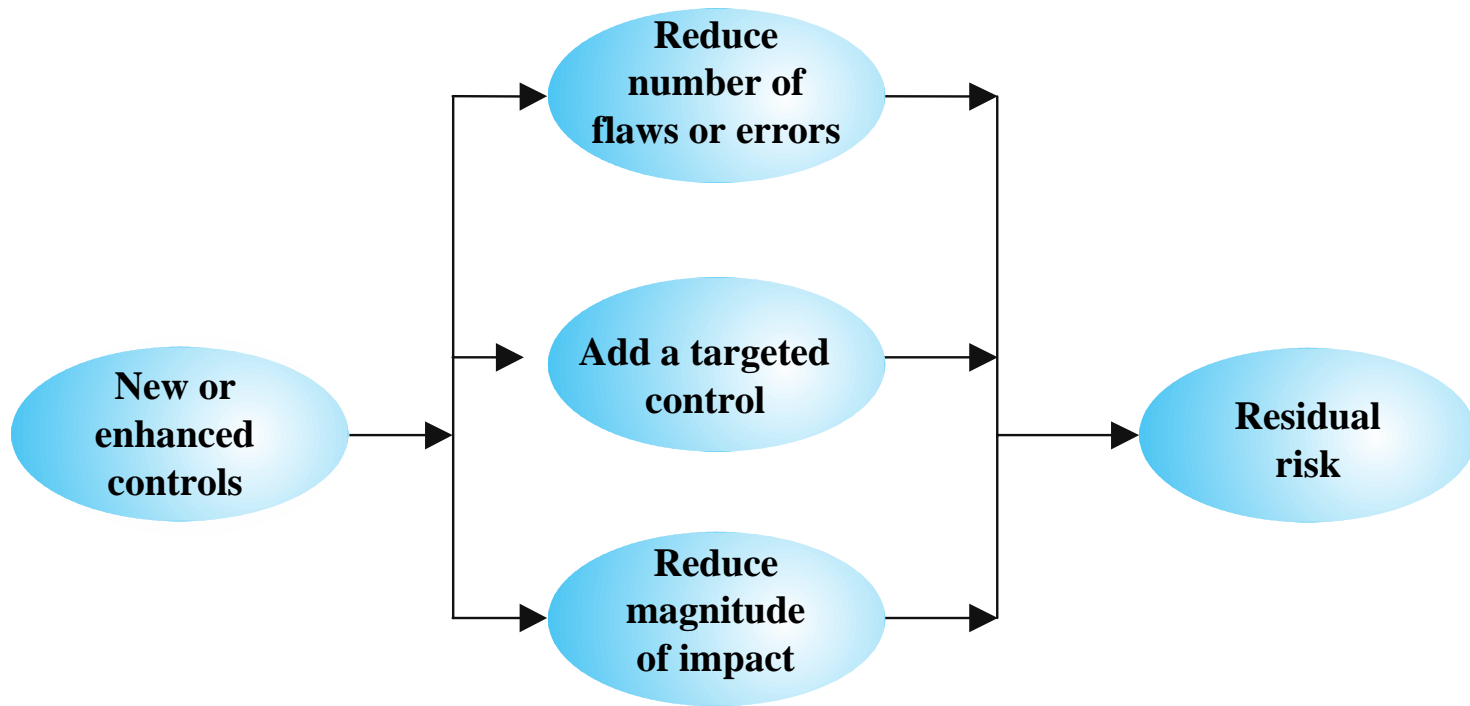


Figure 15.3 Residual Risk

Cost-Benefit Analysis

Should be conducted by management to identify controls that provide the greatest benefit to the organization given the available resources

May be qualitative or quantitative

Must show cost justified by reduction in risk

Should contrast the impact of implementing a control or not, and an estimation of cost

Management chooses selection of controls

Considers if it reduces risk too much or not enough, is too costly or appropriate

Fundamentally a business decision

IT Security Plan

- Provides details of:
 - What will be done
 - What resources are needed
 - Who is responsible
- Goal is to detail the actions needed to improve the identified deficiencies in the risk profile

Should include

Risks,
recommended
controls, action
priority

Selected controls,
resources needed

Responsible
personnel,
implementation
dates

Maintenance
requirements

Implementation Plan

| | |
|--------------------------------|--|
| Risk (Asset/Threat) | Hacker attack on Internet router |
| Level of Risk | High |
| Recommended Controls | <ul style="list-style-type: none">•Disable external telnet access•Use detailed auditing of privileged command use•Set policy for strong admin passwords•Set backup strategy for router configuration file•Set change control policy for the router configuration |
| Priority | High |
| Selected Controls | <ul style="list-style-type: none">•Implement all recommended controls•Update related procedures with training for affected staff |
| Required Resources | <ul style="list-style-type: none">•3 days IT net admin time to change & verify router configuration, write policies;•1 day of training for network administration staff |
| Responsible Persons | John Doe, Lead Network System Administrator, Corporate IT Support Team |
| Start – End Date | February 6, 2017 to February 9, 2017 |
| Other Comments | <ul style="list-style-type: none">•Need periodic test and review of configuration and policy use |

Security Plan Implementation

IT security plan documents:

- What needs to be done for each selected control
- Personnel responsible
- Resources and time frame

Identified personnel:

- Implement new or enhanced controls
- May need system configuration changes, upgrades or new system installation
- May also involve development of new or extended procedures
- Need to be encouraged and monitored by management

When implementation is completed management authorizes the system for operational use

Implementation Follow-Up

- Security management is a cyclic process
 - Constantly repeated to respond to changes in the IT systems and the risk environment
- Need to monitor implemented controls
- Evaluate changes for security implications
 - Otherwise increase chance of security breach

Includes a number of aspects

- Maintenance of security controls
- Security compliance checking
- Change and configuration management
- Incident handling

Maintenance

- Need continued maintenance and monitoring of implemented controls to ensure continued correct functioning and appropriateness
- Goal is to ensure controls perform as intended

**Periodic
review of
controls**

**Upgrade of
controls to
meet new
requirements**

**System
changes do not
impact
controls**

**Address new
threats or
vulnerabilities**

Tasks

Security Compliance

- Audit process to review security processes
- Goal is to verify compliance with security plan
- Use internal or external personnel
- Usually based on use of checklists which verify:
 - Suitable policies and plans were created
 - Suitable selection of controls were chosen
 - That they are maintained and used correctly
- Often as part of wider general audit

Change and Configuration Management

Change management is the process to review proposed changes to systems

Configuration management is specifically concerned with keeping track of the configuration of each system in use and the changes made to them

May be informal or formal

Test patches to make sure they do not adversely affect other applications

Important component of general systems administration process

Evaluate the impact

Also part of general systems administration process

Know what patches or upgrades might be relevant

Keep lists of hardware and software versions installed on each system to help restore them following a failure

Case Study: Silver Star Mines

- Given risk assessment, the next stage is to identify possible controls
- Based on assessment it is clear many categories are not in use
- General issue of systems not being patched or upgraded
- Need contingency plans
- SCADA: add intrusion detection system
- Info integrity: better centralize storage
- Email: provide backup system

Silver Star Mines: Implementation Plan

| Risk (Asset/Threat) | Level of Risk | Recommended Controls | Priority | Selected Controls |
|---|----------------------|---|-----------------|--|
| All risks (generally applicable) | | <ol style="list-style-type: none"> 1. Configuration and periodic maintenance policy for servers 2. Malicious code (SPAM, spyware) prevention 3. Audit monitoring, analysis, reduction, and reporting on servers 4. Contingency planning and incident response policies and procedures 5. System backup and recovery procedures | 1 | <ol style="list-style-type: none"> 1. 2. 3. 4. 5. |
| Reliability and integrity of SCADA nodes and network | High | <ol style="list-style-type: none"> 1. Intrusion detection and response system | 2 | <ol style="list-style-type: none"> 1. |
| Integrity of stored file and database information | Extreme | <ol style="list-style-type: none"> 1. Audit of critical documents 2. Document creation and storage policy 3. User security education and training | 3 | <ol style="list-style-type: none"> 1. 2. 3. |
| Availability and integrity of Financial, Procurement, and Maintenance/ Production Systems | High | - | - | (general controls) |
| Availability, integrity and confidentiality of e-mail | High | <ol style="list-style-type: none"> 1. Contingency planning – backup e-mail service | 4 | <ol style="list-style-type: none"> 1. |