Information and Network Security

Information Security Governance and Risk Management

Agenda

- Basic Concepts
- Types of Controls
- Risk Analysis and Management
  - Quantified Risk Analysis
  - Risk Management Strategies
- Other Functions of Domain

Basic Concepts of Information Security

- Asset
- Vulnerability
- Threat
- Threat Agent
- Exposure Factor/Impact
- Risk
- Control/Counter Measure/Safeguard

- Asset
  - Anything that is of value for an organization
  - E.g. Information, Software, Hardware, Human
- Vulnerability
  - A weakness /defect in a system or absence of a safeguard
- Threat
  - A threat is a potential danger for an Asset
  - Its an event that if happen will adversely affect an Asset

- Threat Agent
  - The entity which causes threat to happen is threat agent.
  - E.g. an intruder in a system, Malware, Nature
- Exposure Factor/Impact
  - Percentage of asset loss caused by threat
- Risk
  - Likelihood of threat agent exploiting a vulnerability and its impact on asset
  - Risk ties the likelihood, vulnerability and threat to the resulting business impact.

Security Controls

- Control/Safeguard/Counter Measure
  - A control is implemented to mitigate the Risk.
  - E.g. Fire Extinguisher, Password Policy, Firewall
- **Types of Controls**
  - **Physical Controls**
    - Guards, Identity Badges, Smoke Detector etc
  - **Logical Controls**
    - Administrative Controls
      - Policies and Procedures
    - Technical Controls
      - Firewall, IDS, Antivirus, Port Binding etc.

Administrative Controls

- Policy
  - A policy is a general statement produced by senior management that dictates what role security will play in organization or what is acceptable and not acceptable generally.
  - Policies are usually broad documents that require procedures to implement them.
- Standards
  - A standard refer to mandatory activities, actions or rules.
  - E.g. ISO 9001, ISO 27001 etc.

Policies, Procedures, Baselines, Guidelines

- Baselines
  - The term baseline refers to a point in time that is used as a comparison for future changes.
  - Baselines are also used to define the minimum level of protection required.
  - In security, specific baselines can be defined per system type, which indicates the necessary settings and the level of protection being provided

Guidelines

- Guidelines are recommended actions and operational guides.
  - Industry best practices falls in this category

Types of Controls (Functionalities)

- Deterrent
- Preventive
- Corrective
- Recovery
- Detective
- Compensating

Control Functionalities

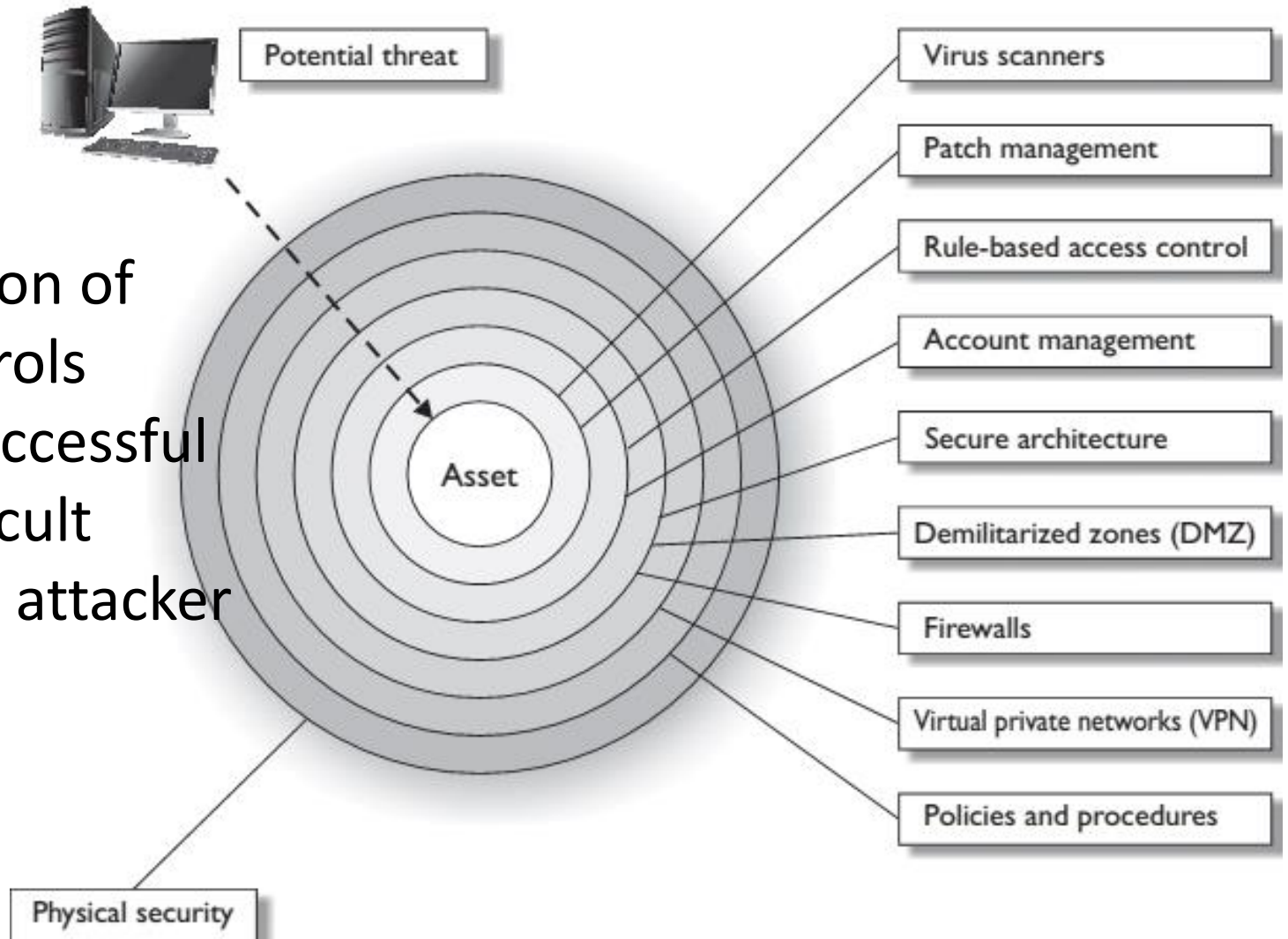
- Six different control functionalities are as follows:
  - **Deterrent** Intended to discourage a potential attacker
  - **Preventive** Intended to avoid an incident from occurring
  - **Corrective** Fixes components or systems after an incident has occurred
  - **Recovery** Intended to bring the environment back to regular operations
  - **Detective** Helps identify an incident's activities and potentially an intruder
  - **Compensating** Controls that provide an alternative measure of control

Control Functionalities

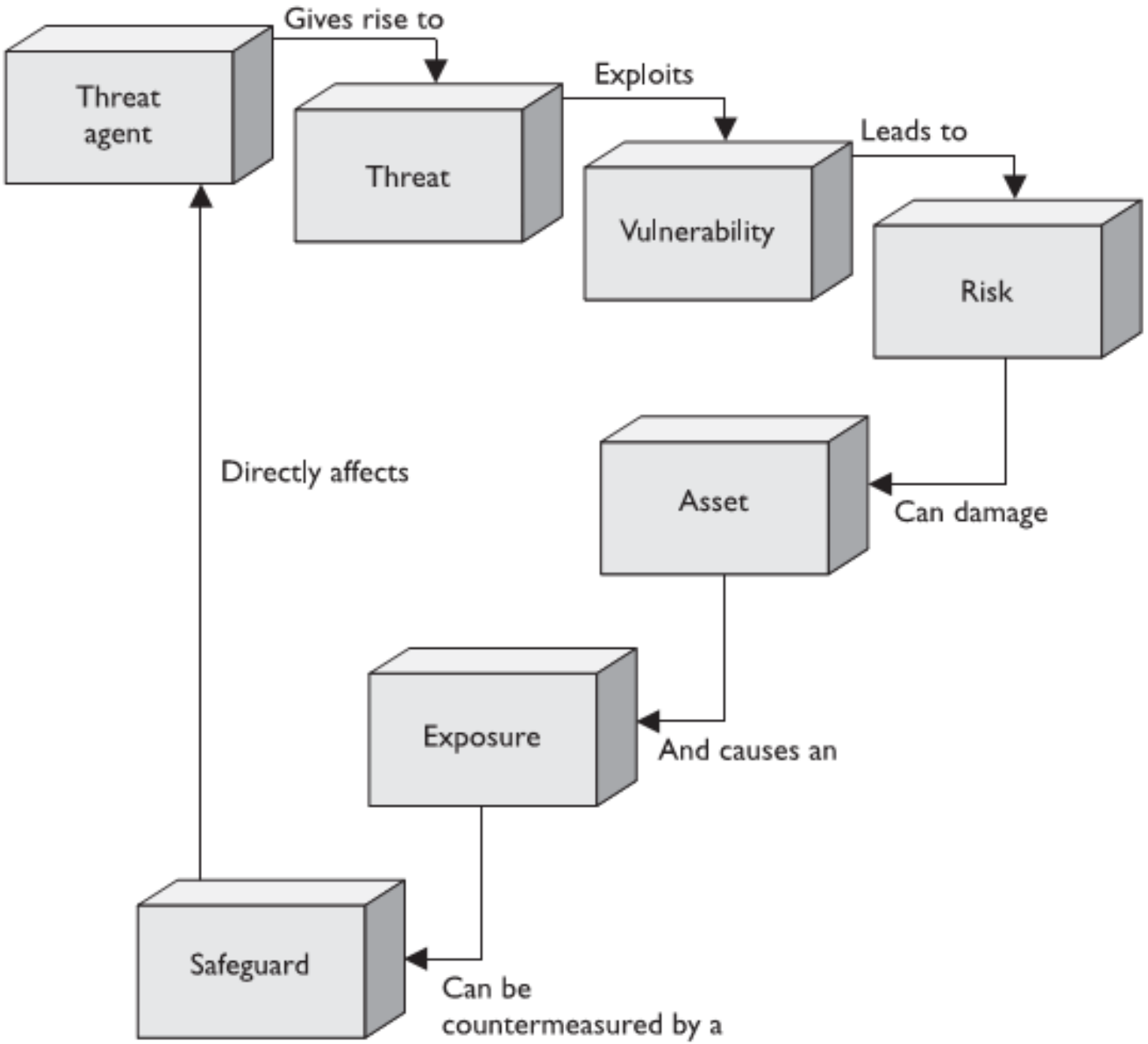
- Preventive: administrative
  - Policies and procedures
  - Effective hiring practices
  - Pre-employment background checks
  - Controlled termination processes
  - Data classification and labeling
  - Security awareness
- Preventive: Physical
  - Badges, swipe cards
  - Guards, dogs
  - Fences, locks, mantraps
- Preventive: Technical
  - Passwords, biometrics, smart cards
  - Encryption, secure protocols, call-back systems, database views, constrained
  - user interfaces
  - Antimalware software, access control lists, firewalls, intrusion prevention system

Defense in Depth

Controls are implemented in layers to ensure defense in depth.



Implementation of multiple controls so that the successful breach is difficult to achieve for attacker

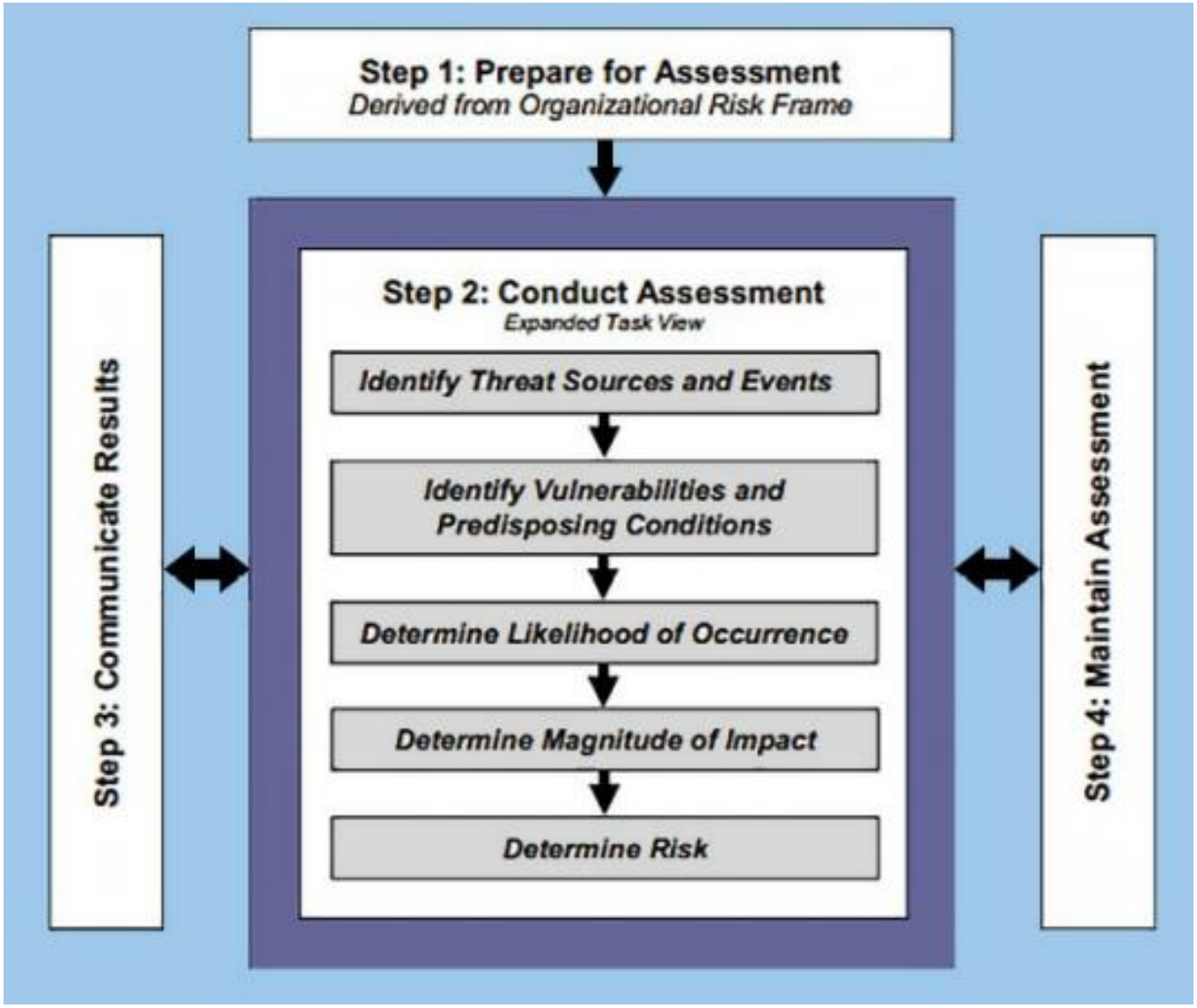


Relationship between discussed concepts

Risk Analysis and Management

- Risk
  - Risk is the likelihood of occurrence of a threat and the damage it causes to the assets.
- Risk = *Likelihood of occurrence of a threat* x *Impact*

NIST Risk Assessment Framework



Risk Analysis

- Before Managing Risk, you have to analyze what risks are prevalent to your organization.
- A Risk analysis consist of four phases:
  1. **Asset Identification**
  2. **Vulnerabilities and Threats to Assets**
  3. **Quantified Likelihood of threat and its impact on asset**
  4. **Cost of Countermeasures**
- Risk Analysis provides a cost/benefit comparison of Risk and cost of countermeasure

Quantified Risk Analysis

- The objective is to assign dollar value to risk.
- **SLE**
  - defined as the difference between the original value and the remaining value of an asset after a single impact of a threat.
  - **SLE** = asset value (in $) × exposure factor as a %)
- **ARO**
  - Measures the likelihood of threat
  - an estimate of how often a threat will be successful in exploiting a vulnerability over the period of a year
- **ALE**
  - ARO * SLE
- Once we have a value of Risk, we can decide how we want to manage risk.

- **Cost benefit analysis (CBA)** Also known as an economic feasibility study, the formal assessment and presentation of the economic expenditures needed for a particular security control, contrasted with its projected value to the organization.
- **single loss expectancy (SLE)** In a cost-benefit analysis, the calculated value associated with the most likely loss from an attack. The SLE is the product of the asset's value and the exposure factor.
- **exposure factor (EF)** In a cost-benefit analysis, the expected percentage of loss that would occur from a particular attack.
- **annualized rate of occurrence (ARO)** In a cost-benefit analysis, the expected frequency of an attack, expressed on a per-year basis.
- **annualized loss expectancy (ALE)** In a cost-benefit analysis, the product of the annualized rate of occurrence and single loss expectancy.

Risk Management Strategies

- Risk Acceptance
- Risk Avoidance
- Risk Transfer
- Risk Mitigation

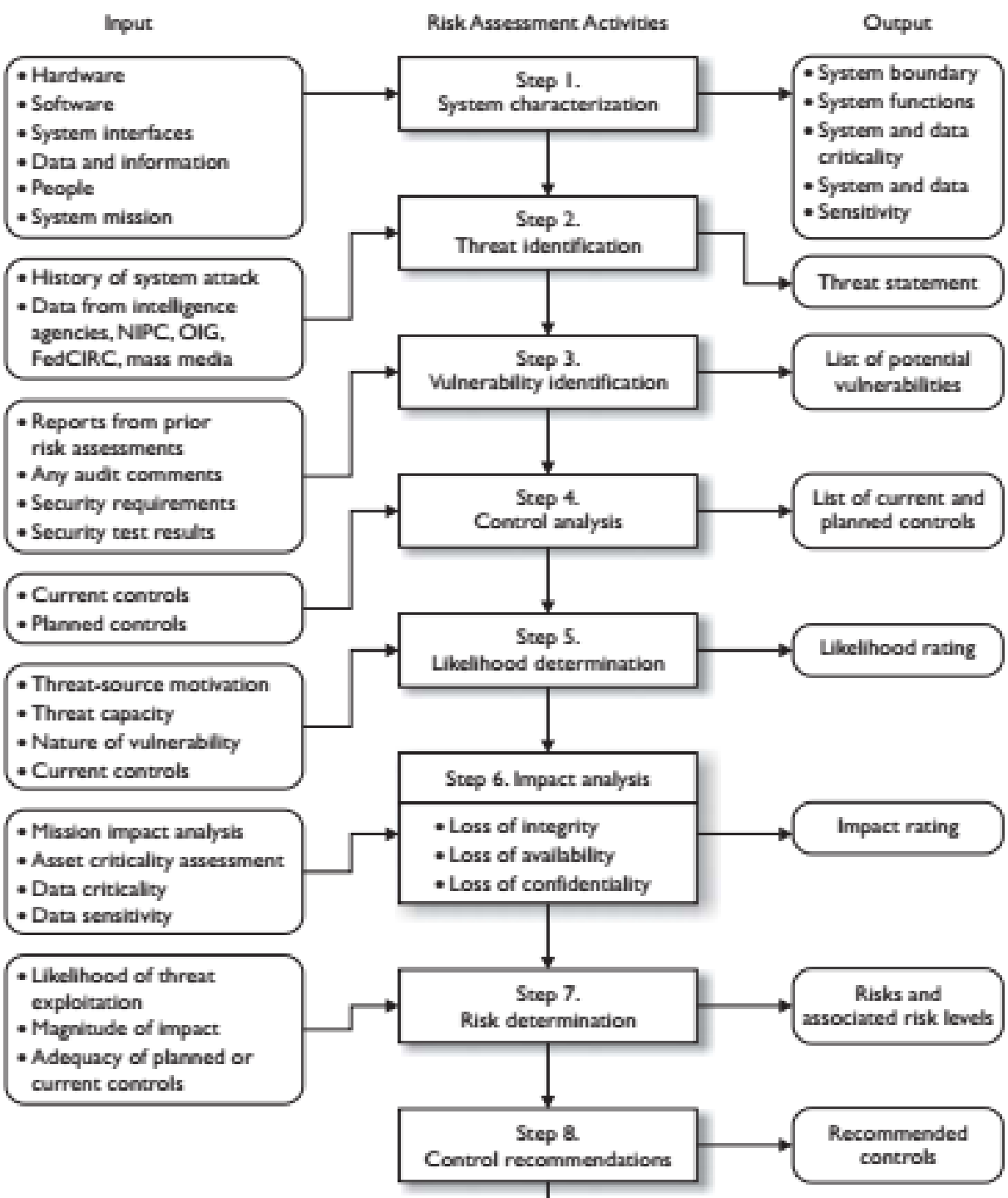
Other Functions of Information Security Management

- Personnel Security
  - Properly hiring and managing personnel
- Security Awareness and Trainings
- Security Monitoring and Audits

Information Security Auditing

- Verification of implementation and Proper working of control
- Auditing is performed against some benchmark i.e. Standard or Guidelines
  - E.g. ISO 27000 Information Security Management System requirements

- System characterization
- Threat identification
- Vulnerability identification
- Control analysis
- Likelihood determination
- Impact analysis
- Risk determination
- Control recommendations
- Results documentation


Input
Risk Assessment Activities
Output
• Hardware
• Software
• System interfaces
• Data and information
• People
• System mission
Step 1.
System characterization
• System boundary
• System functions
• System and data criticality
• System and data sensitivity
• History of system attack
• Data from intelligence agencies, NIPC, OIG, FedCIRC, mass media
Step 2.
Threat identification
Threat statement
• Reports from prior risk assessments
• Any audit comments
• Security requirements
• Security test results
Step 3.
Vulnerability identification
List of potential vulnerabilities
• Current controls
• Planned controls
Step 4.
Control analysis
List of current and planned controls
• Threat-source motivation
• Threat capacity
• Nature of vulnerability
• Current controls
Step 5.
Likelihood determination
Likelihood rating
• Mission impact analysis
• Asset criticality assessment
• Data criticality
• Data sensitivity
Step 6. Impact analysis
• Loss of integrity
• Loss of availability
• Loss of confidentiality
Impact rating
• Likelihood of threat exploitation
• Magnitude of impact
• Adequacy of planned or current controls
Step 7.
Risk determination
Risks and associated risk levels
Step 8.
Control recommendations
Recommended controls