Safety-Related Requirements And Their Relationships To Other Types Of System Requirements

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Topics

Safety and Security Ontology:

- Asset, Harm, Abuse, Vulnerability, Abuser, Hazard, Risk
- Scope of Safety/Security Analysis

Safety and Safety Engineering

Quality Model:

- Quality Characteristics
- Quality Attributes

Types of Requirements

Safety- and Security-Related Requirements

Safety/Security Analysis (SA) – Ontology

Foundational Concepts:

- Asset, Harm, Abuse (Mishap/Misuse), Vulnerability, Abuser, Danger (Hazard/Threat), Risk

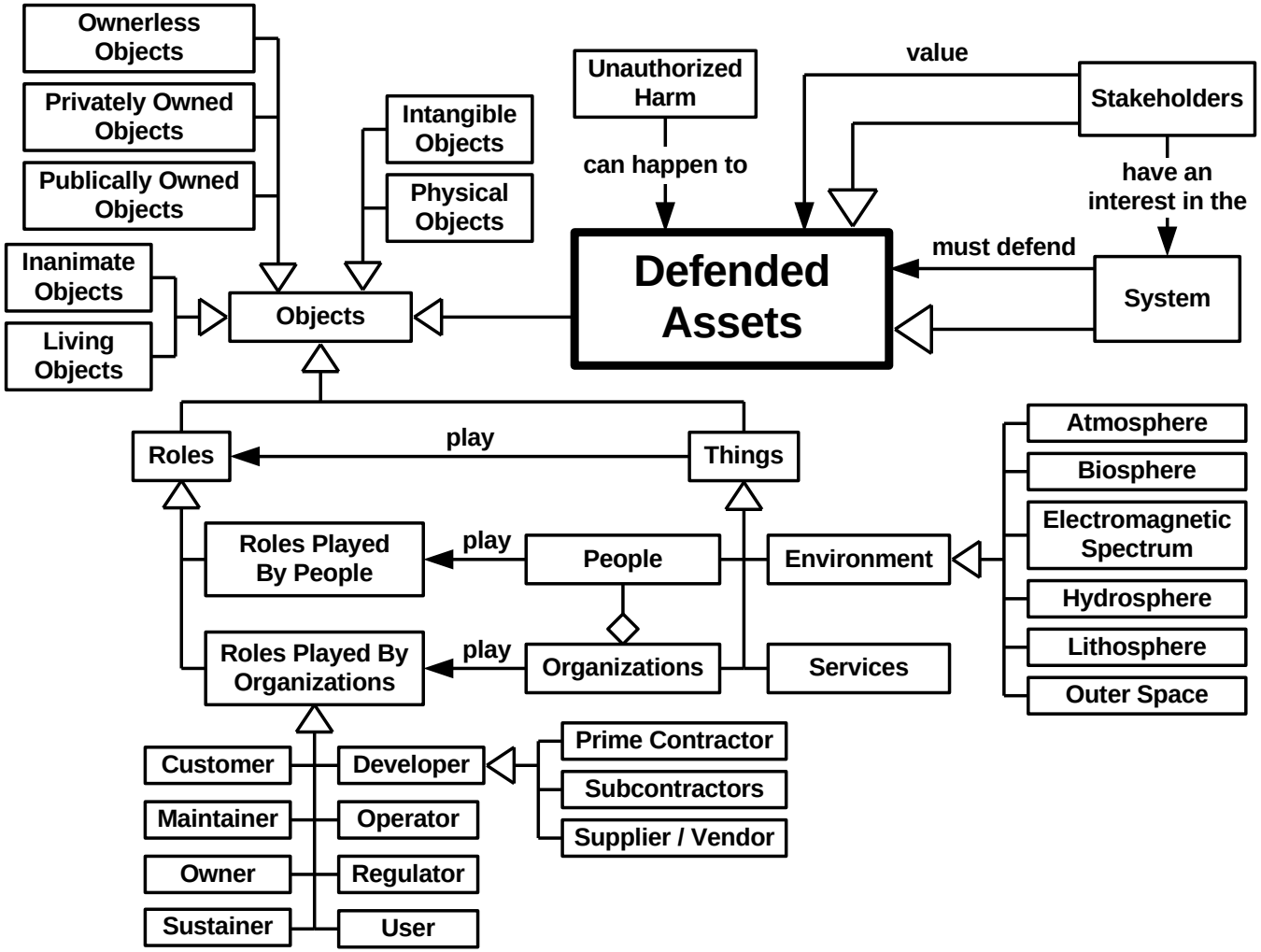
Foundation of:

- Safety/Security Analysis
- Safety/Security Requirements

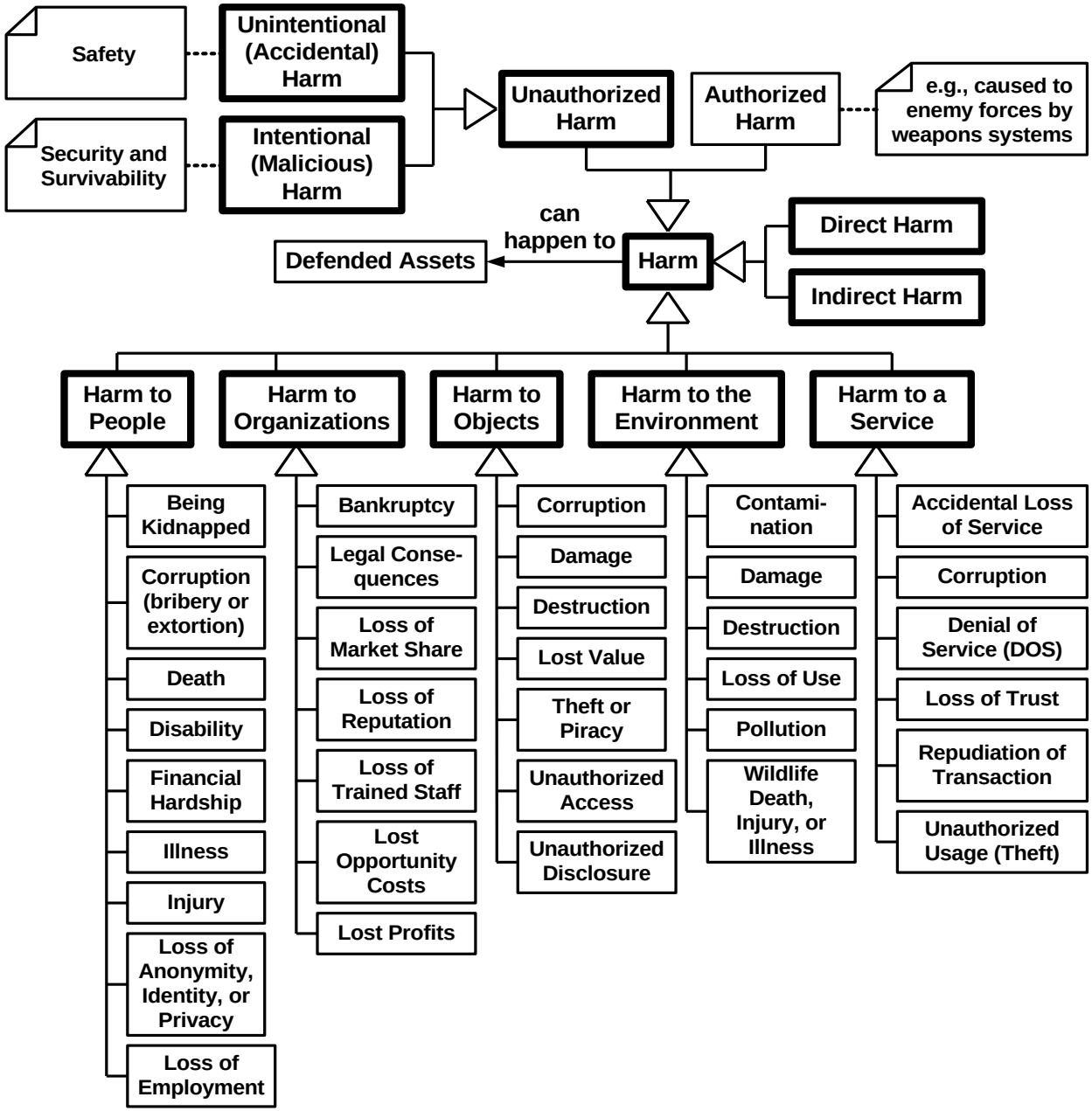
People are often not careful in their usage of these terms:

- Confuse Hazard and Abuse/Vulnerability
- Confuse Threat and Abuser

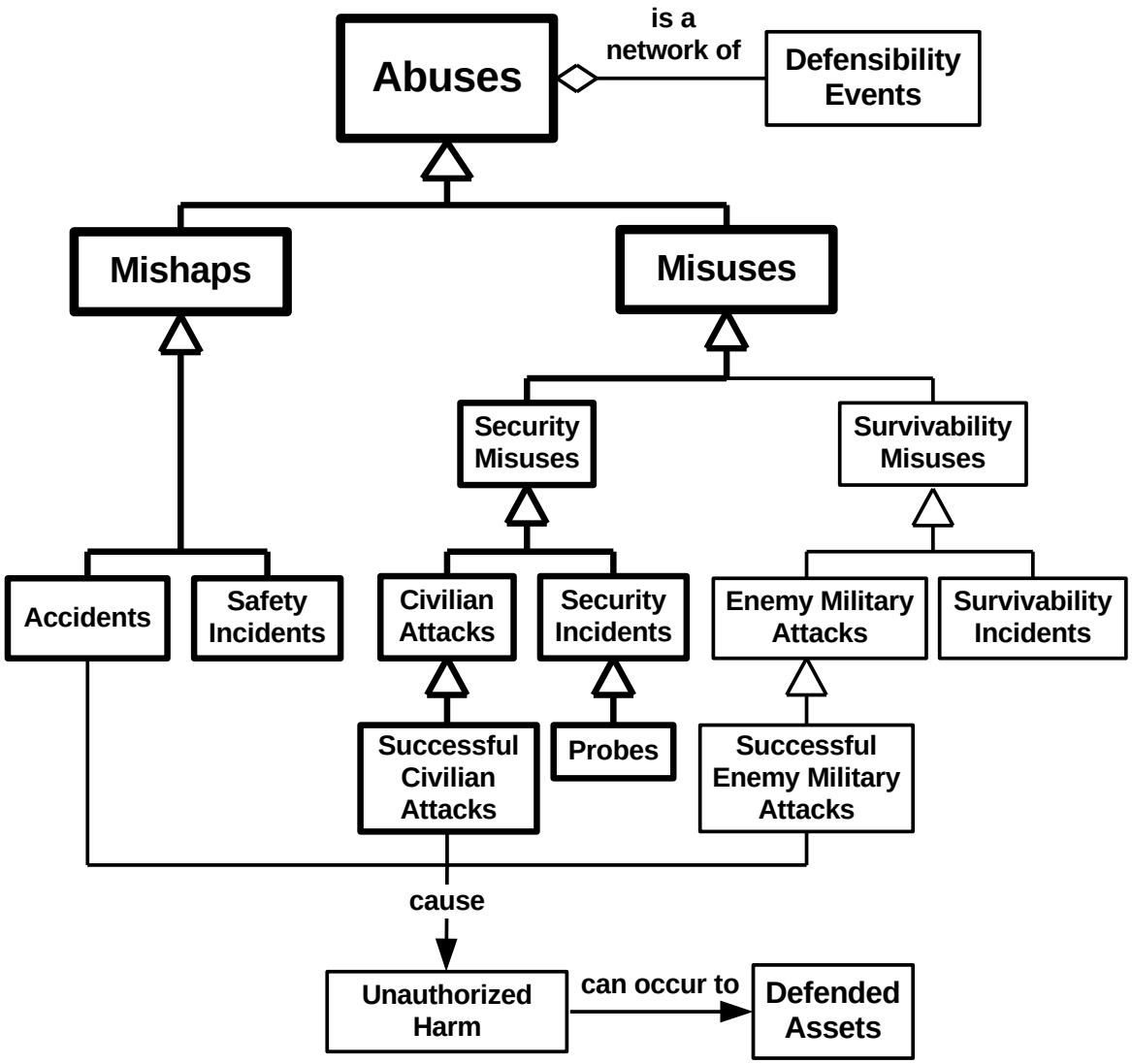
SA – Assets



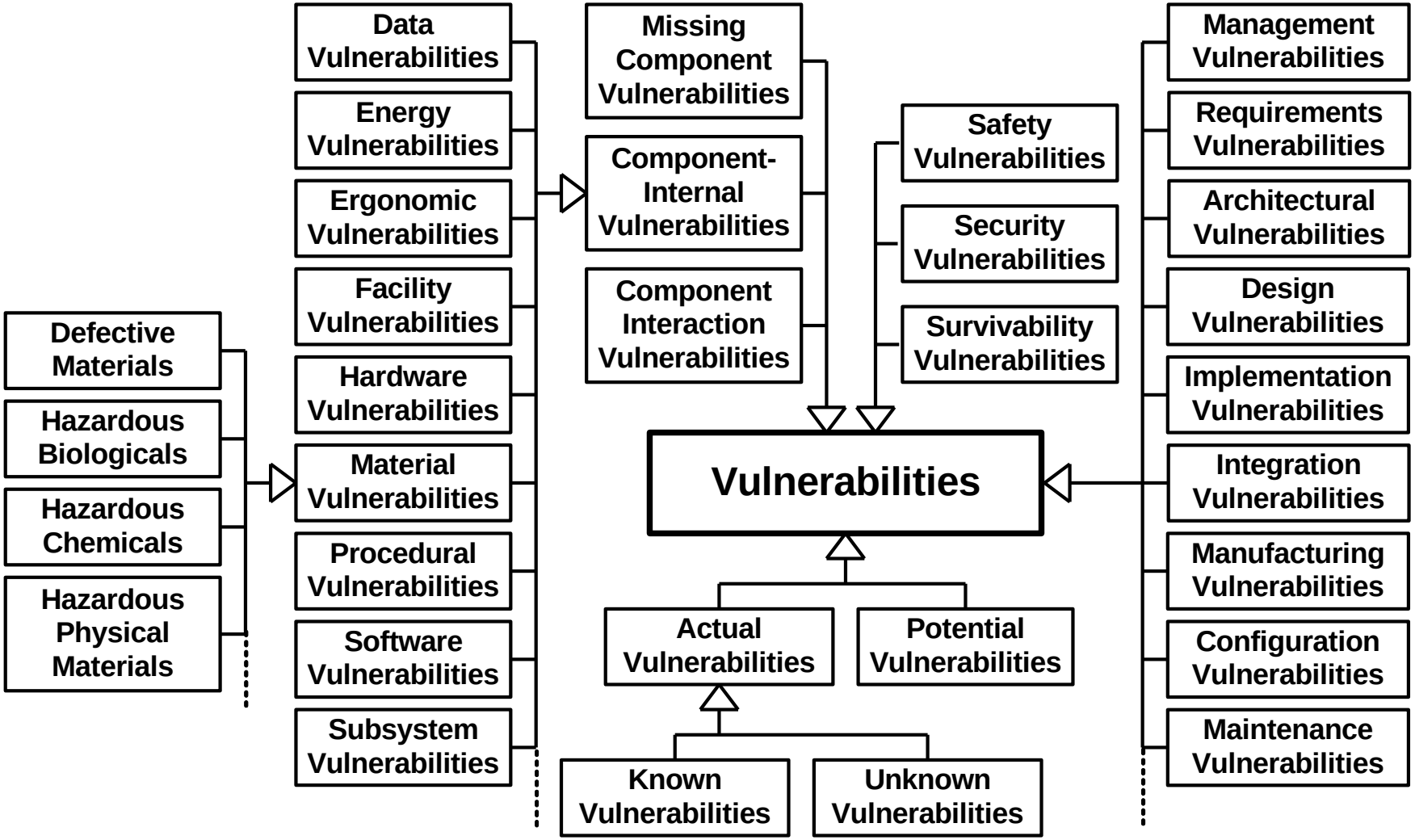
SA – Harm



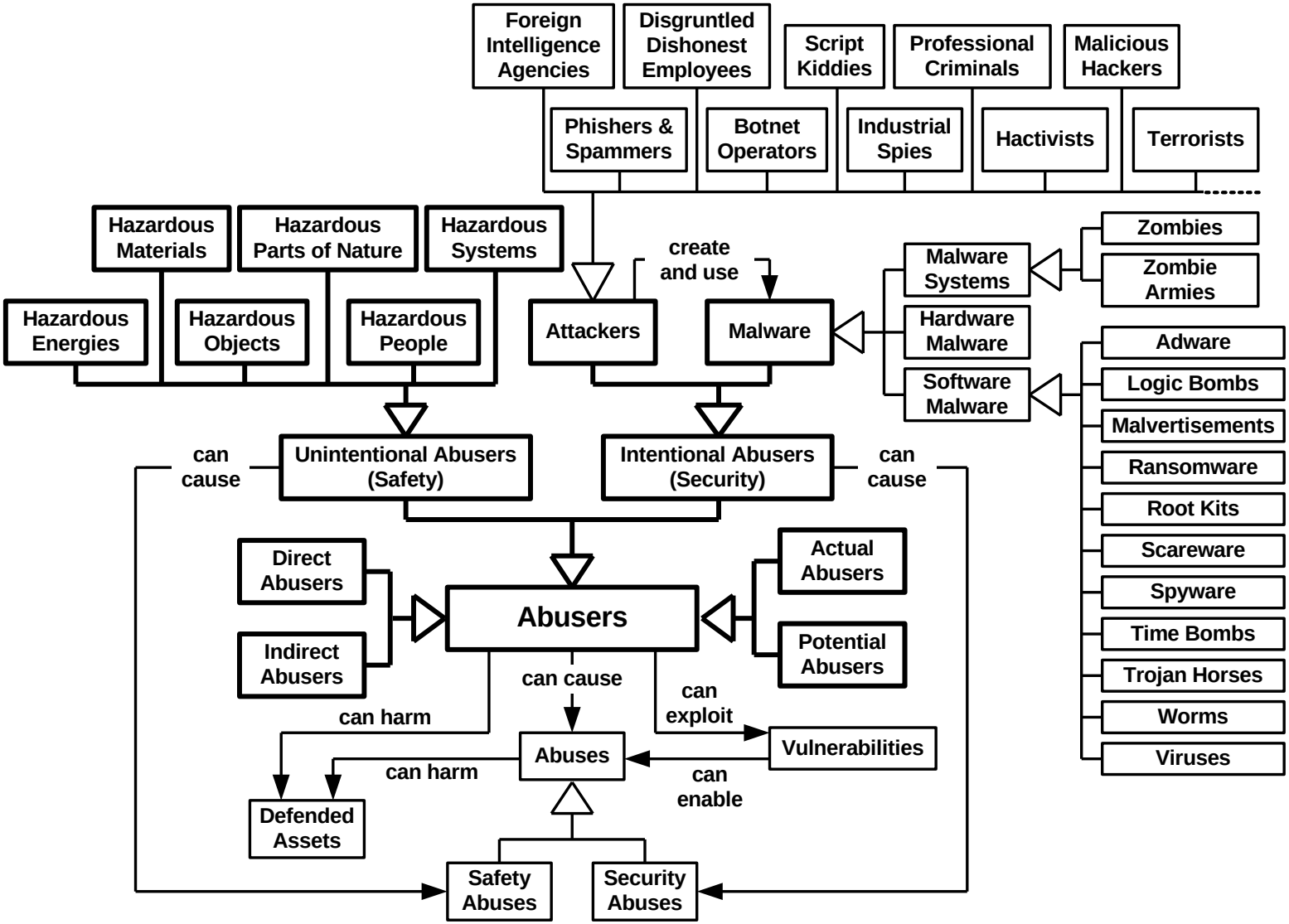
SA – Abuses



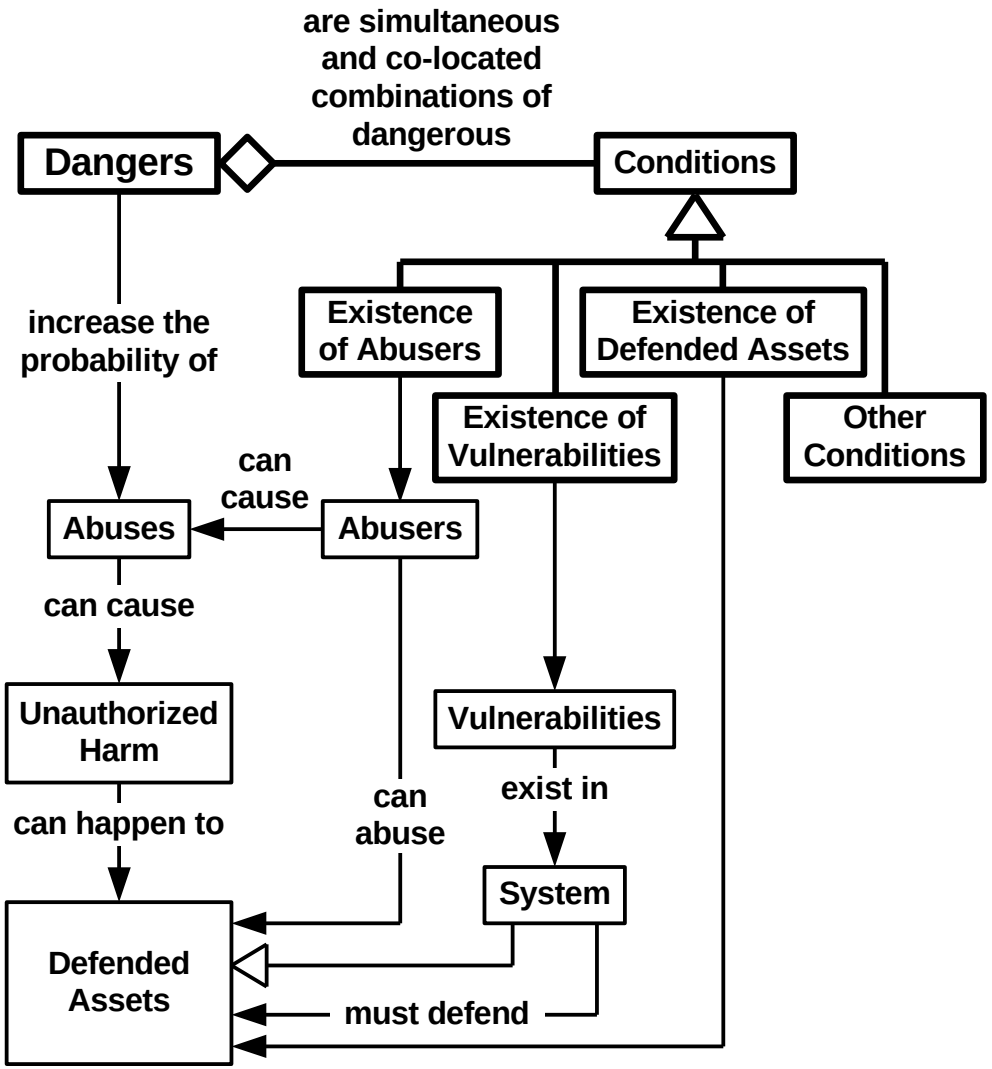
SA – Vulnerabilities



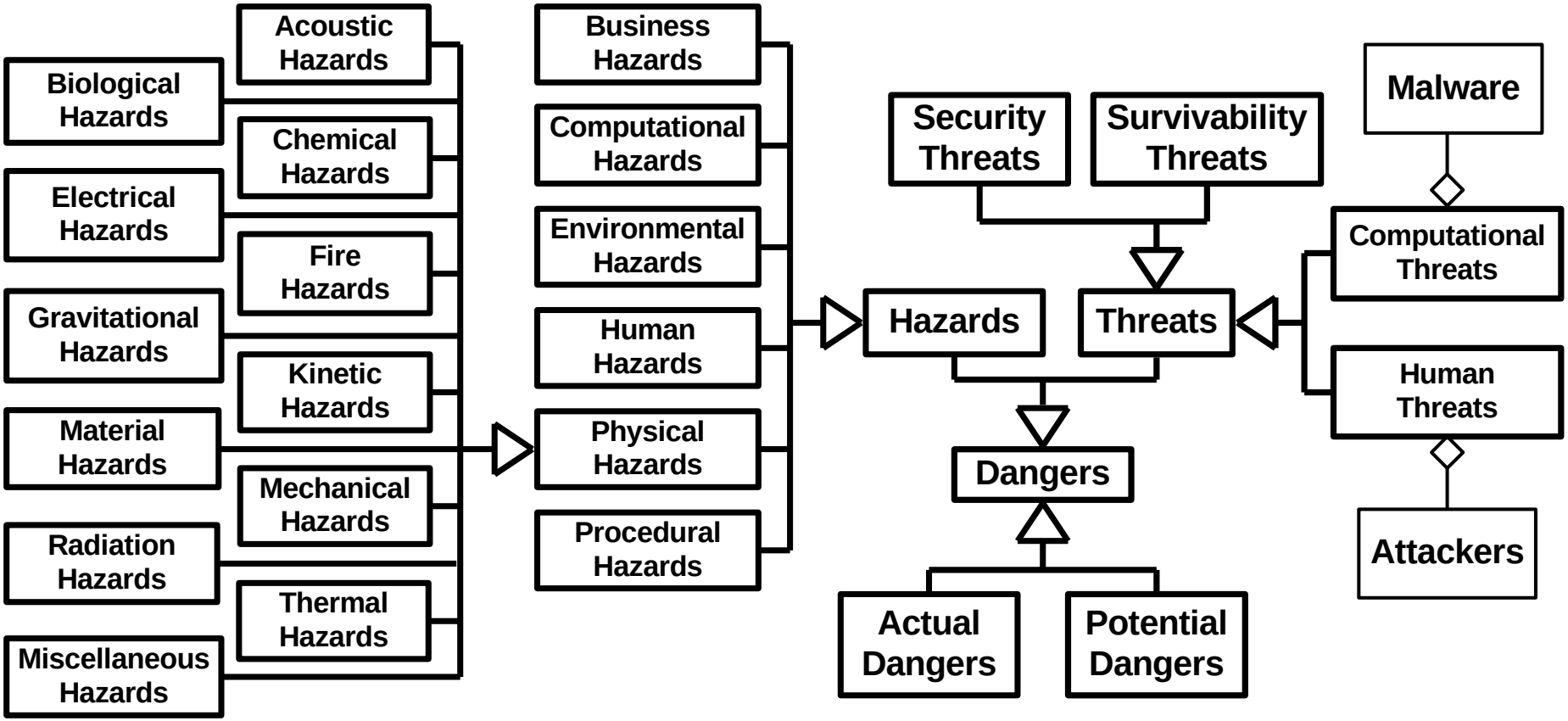
SA – Abusers



SA – Hazards 1



SA – Hazards 2 – Categories of Dangers



Safety as a Quality Characteristic

Safety is *degree* to which:

- the system:
  - *Prevents (eliminates, mitigates, makes sufficiently rare)*
  - *Detects*
  - *Reacts to*
- the following:
  - *Accidental harm* to defended assets
  - *Safety abuses (mishaps such as accidents and near misses)*
  - *Safety abusers (people, systems, and the environment)*
  - *Safety vulnerabilities*
  - *Hazards* (conditions including the existence of non-malicious abusers who unintentionally exploit system vulnerabilities to accidentally harm vulnerable defended assets)
  - *Safety risks*

Security (civilian) and **Survivability** (military) can be defined analogously.

Defensibility, Safety, and Security

Safety Engineering

the systems engineering discipline concerned with lowering the risk of *unintentional* (i.e., *accidental*) *unauthorized* harm to defended assets to a level that is acceptable to the system's stakeholders by preventing, detecting, and properly reacting to such harm, *mishaps* (i.e., *accidents* and safety incidents), system-internal vulnerabilities, system-external *unintentional* abusers, *hazards*, and *safety* risks

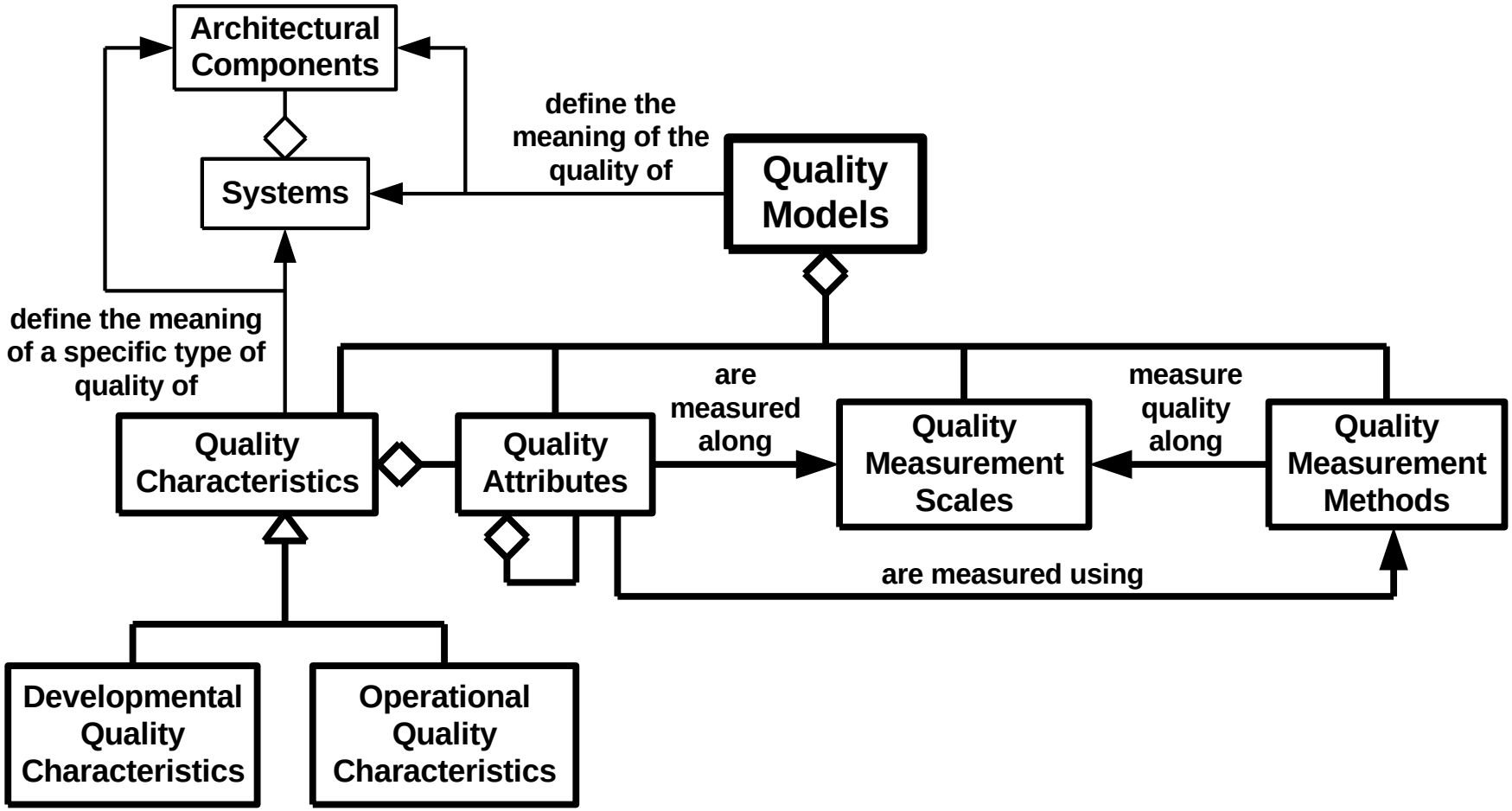
Security Engineering

the systems engineering discipline concerned with lowering the risk of intentional (i.e., malicious) unauthorized harm to defended assets to a level that is acceptable to the system's stakeholders by preventing, detecting, and properly reacting to such harm, civilian misuses (i.e., attacks and security incidents), system-internal vulnerabilities, system-external intentional civilian abusers, threats, and security risks

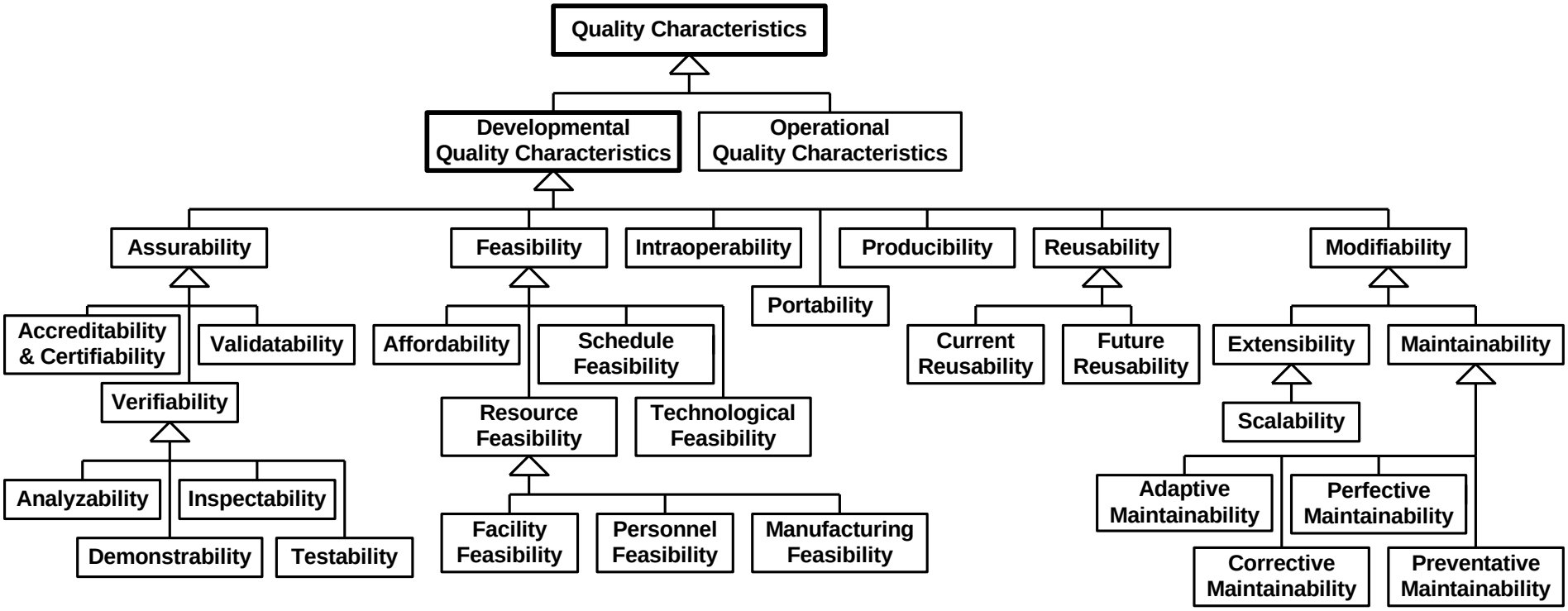
Survivability Engineering

the systems engineering discipline concerned with lowering the risk of *intentional* (i.e., *malicious*) unauthorized harm to defended assets to a level that is acceptable to the system's stakeholders by preventing, detecting, and properly reacting to such harm, *military misuses* (i.e., *attacks* and survivability incidents), system-internal vulnerabilities, system-external *intentional military* abusers, threats, and *survivability* risks

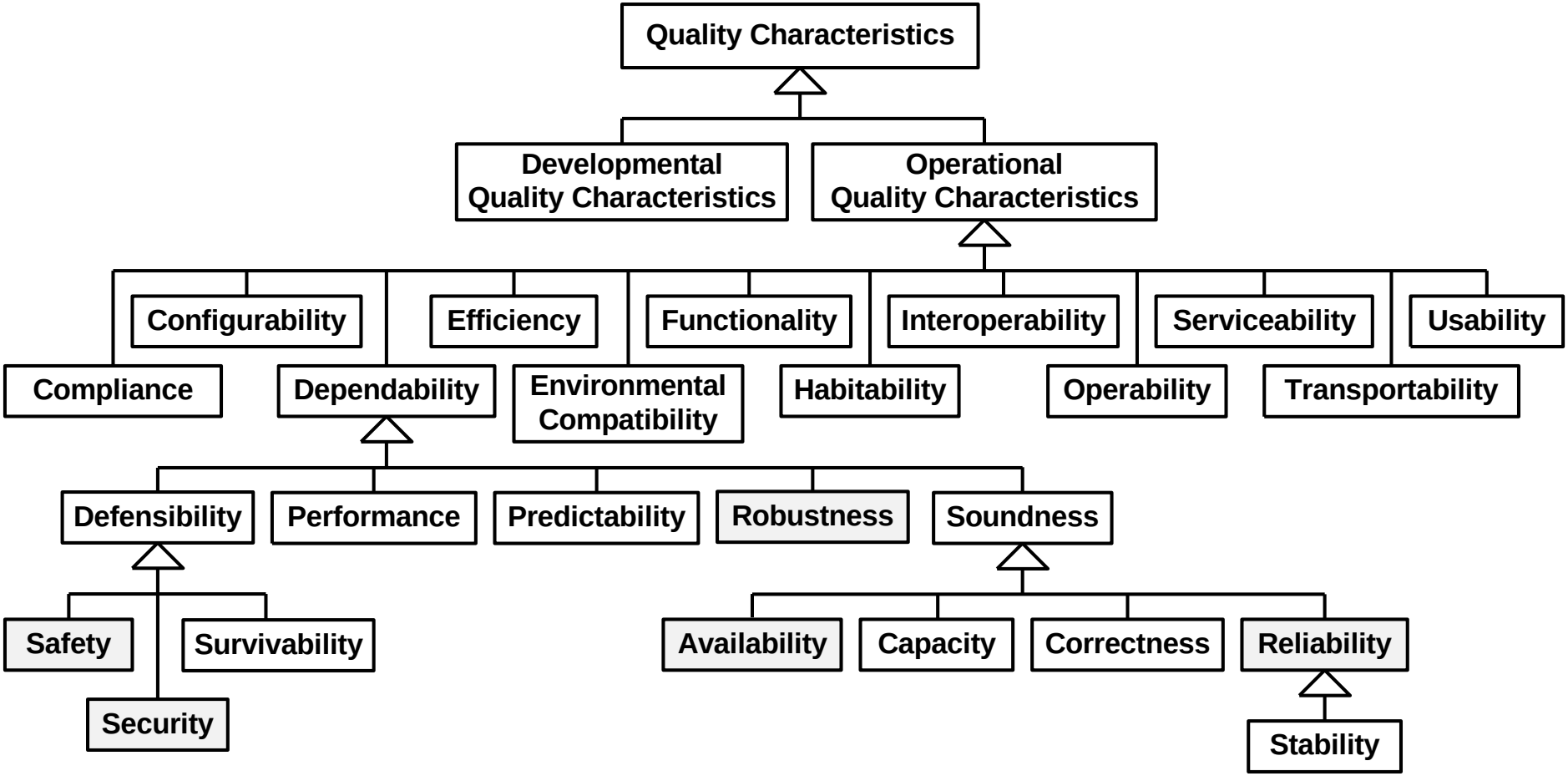
Quality Model (ISO Standard)



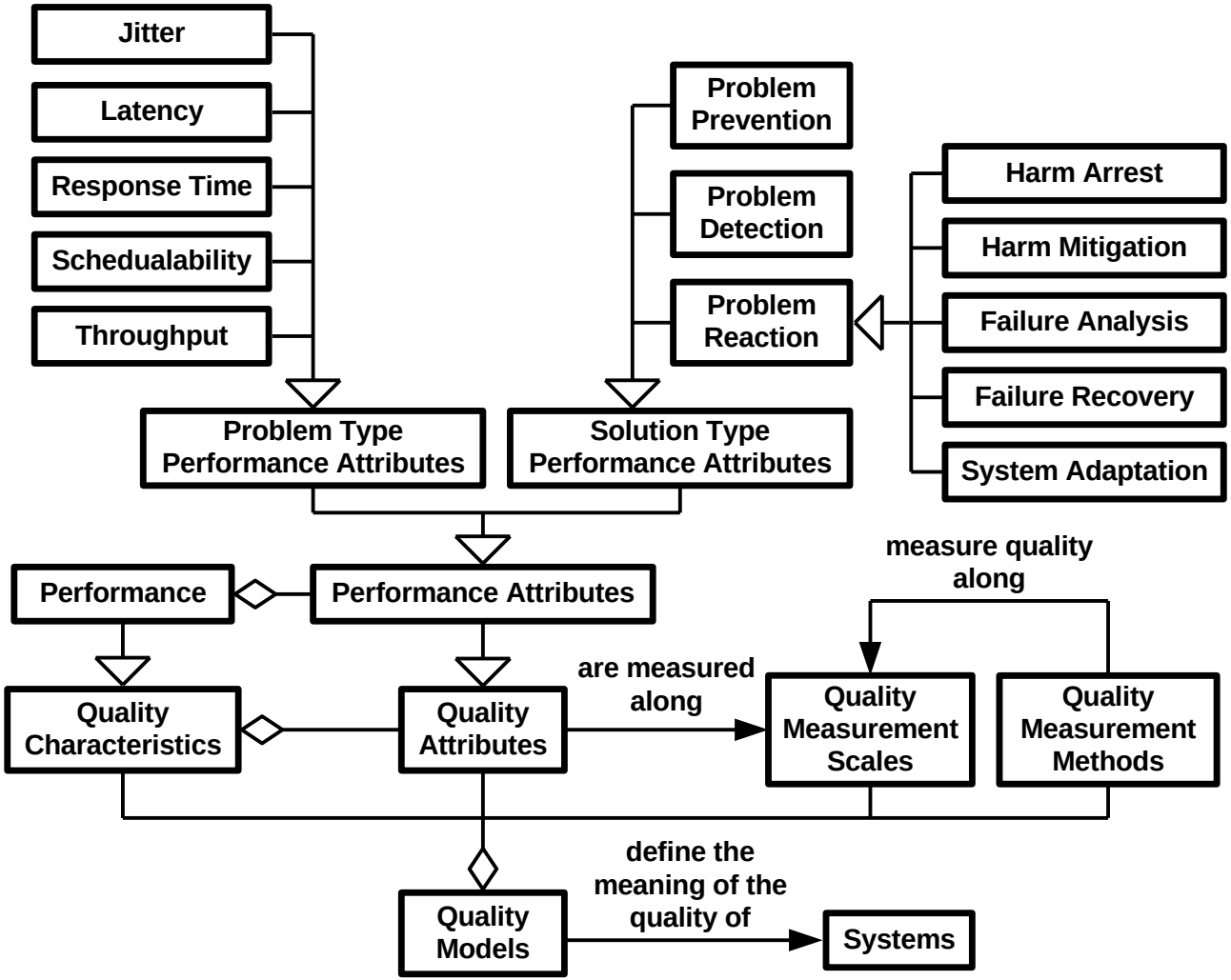
Developmental Quality Characteristics



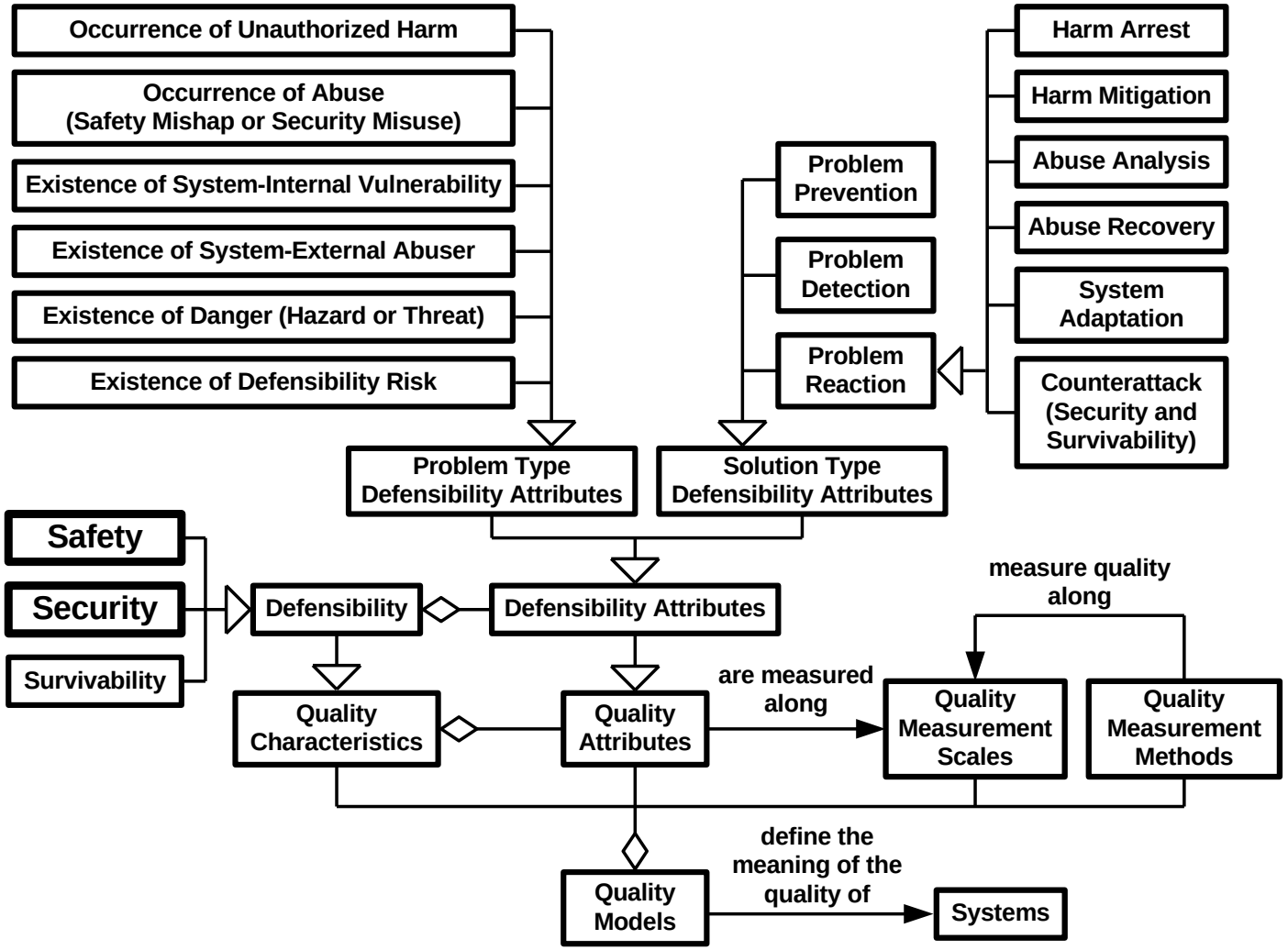
Operational Quality Characteristics



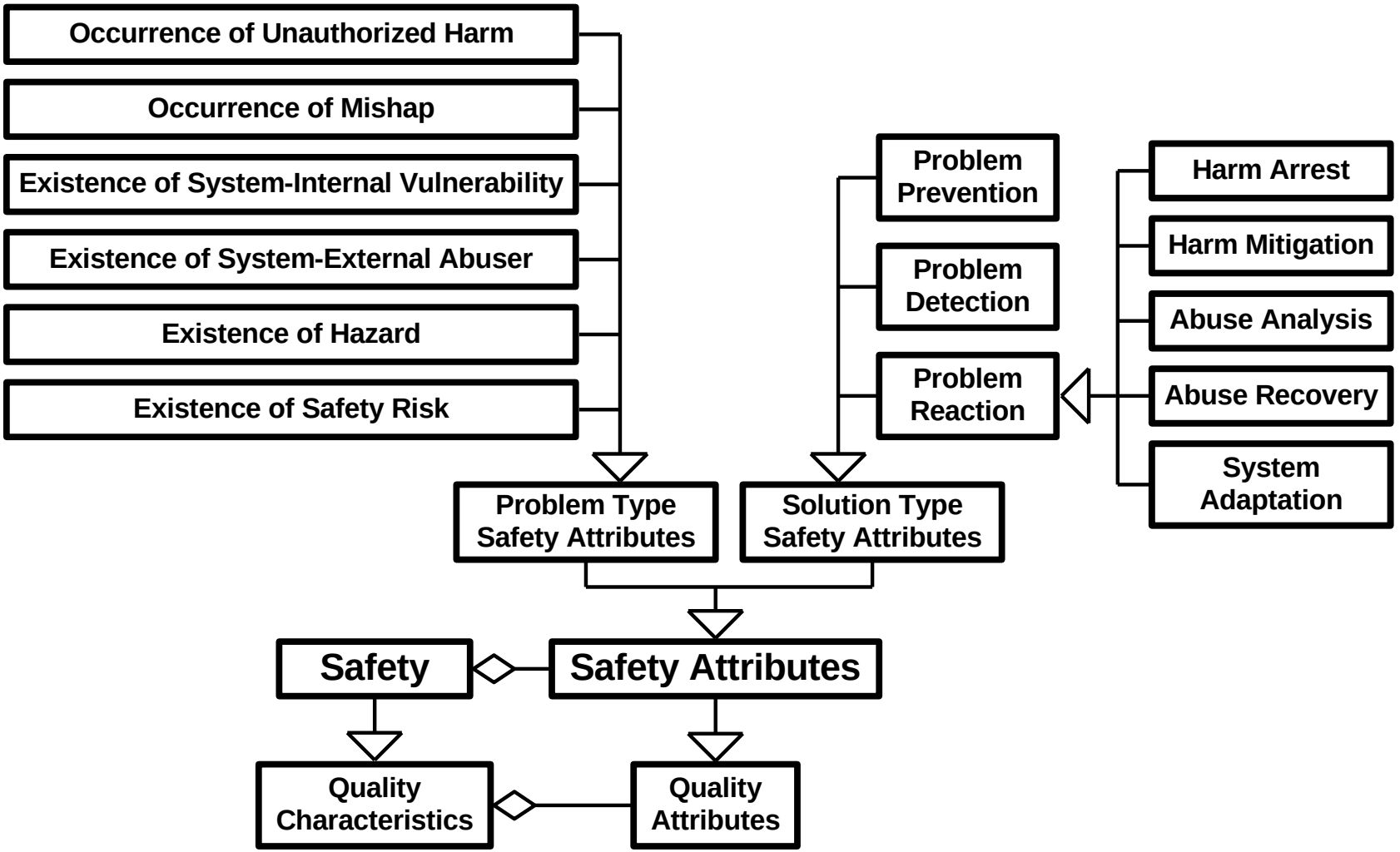
Performance Attributes



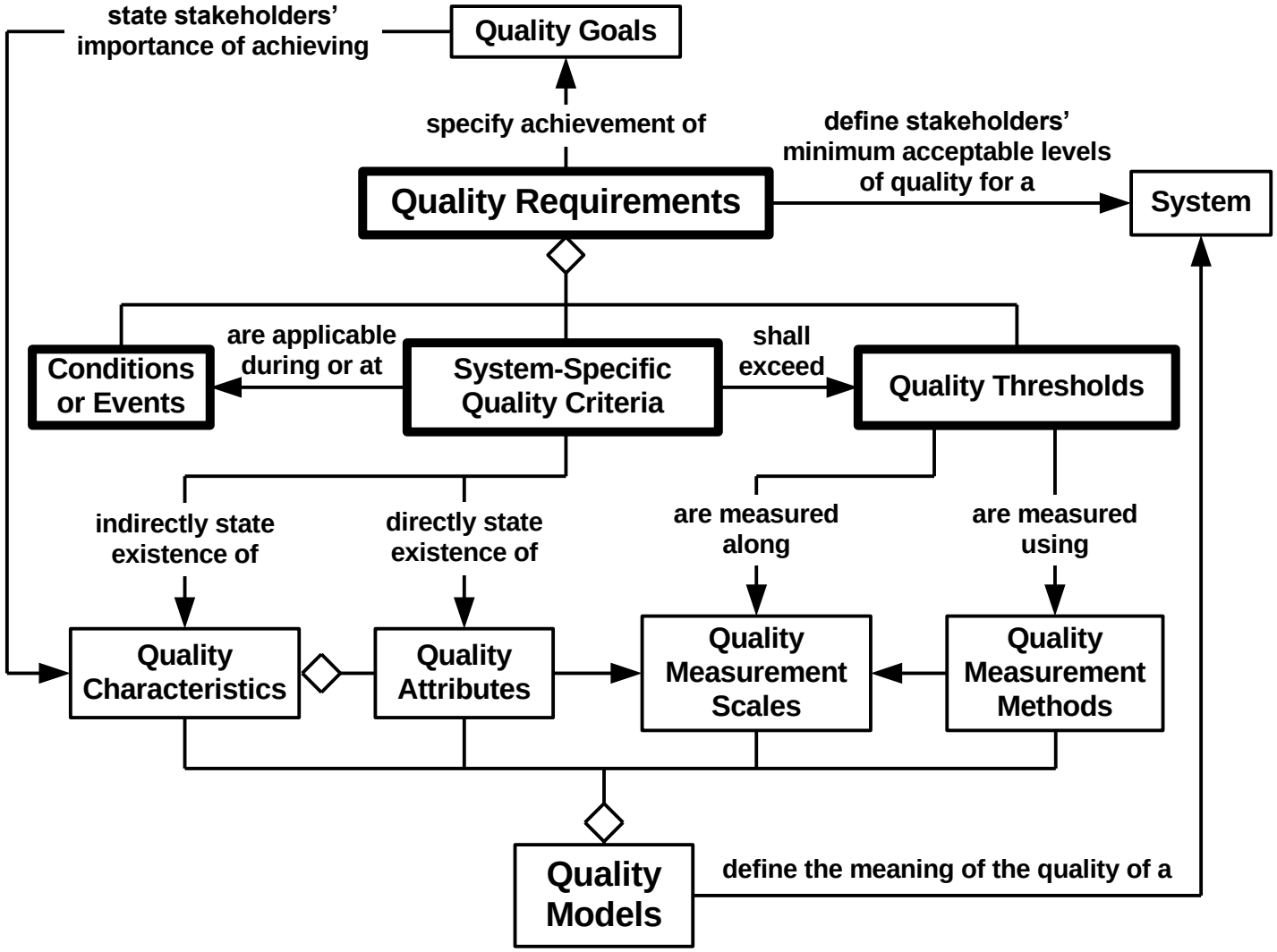
Defensibility Attributes



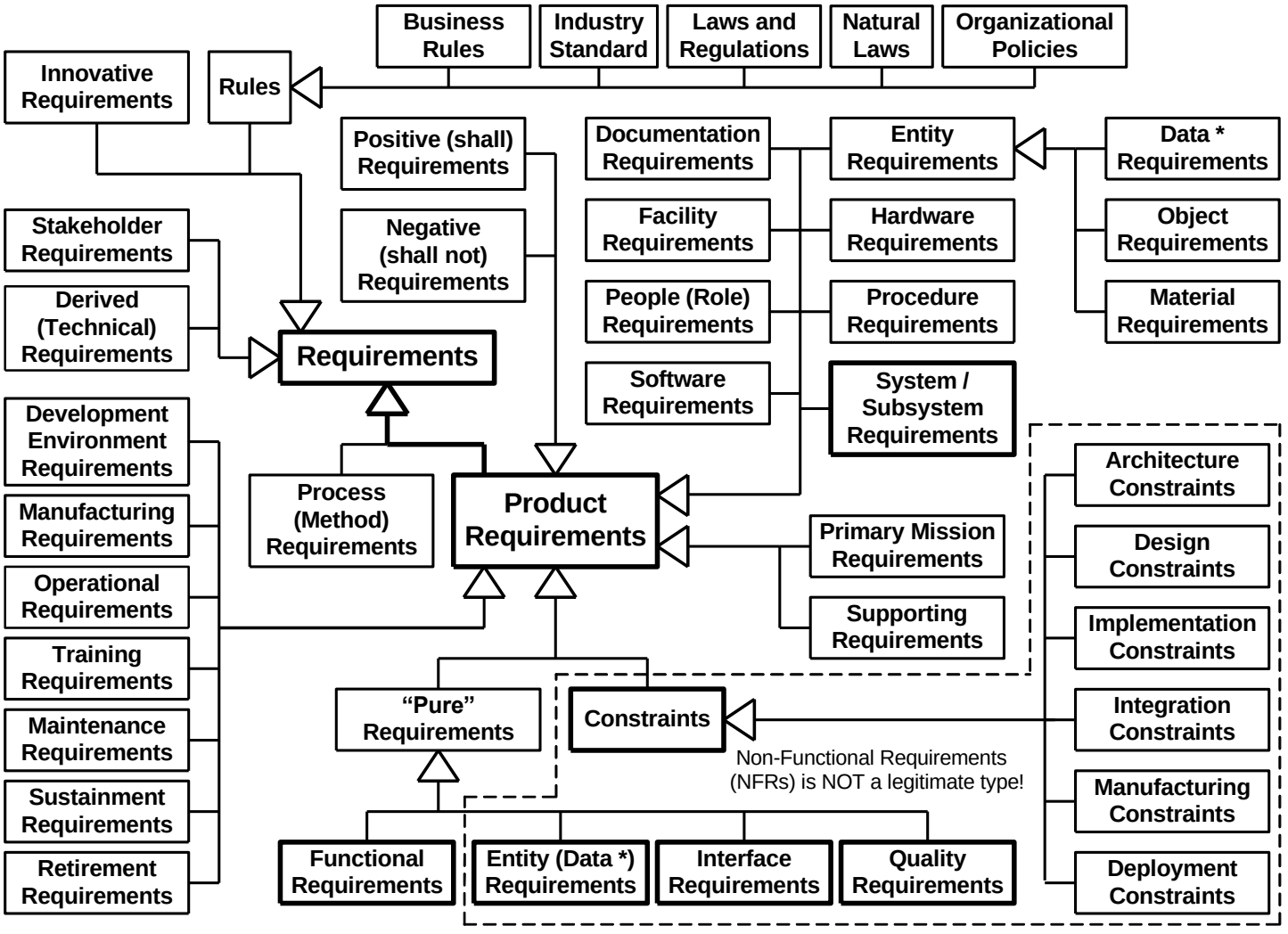
Safety Attributes



Components of a Quality Requirement



Types of Requirements



Defensibility-Related Requirements
Safety- and Security-Related Requirements

Defending Requirements:

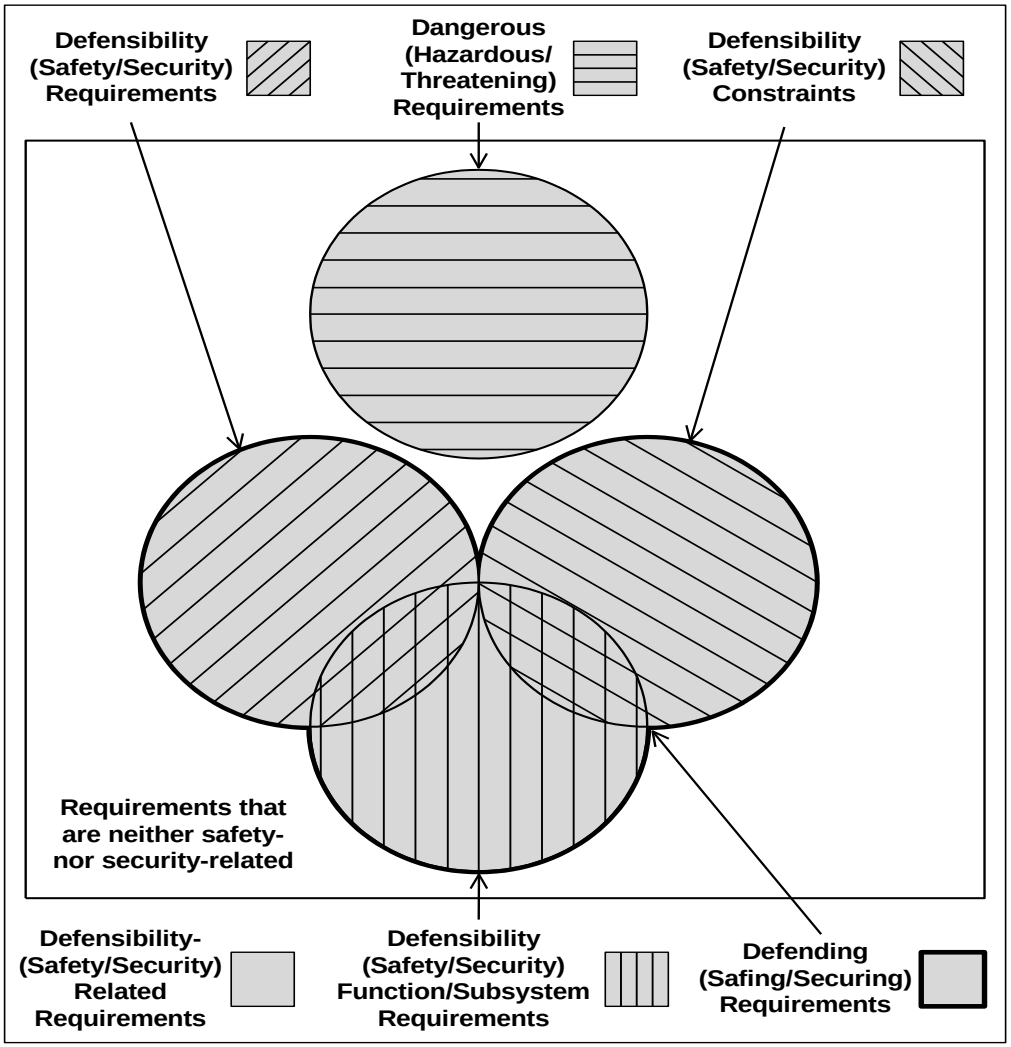
Specifically intended to make the system more safe or secure

- **Defensibility Requirements**
  Quality (Safety/Security) Requirements specifying how safe in terms of protected assets, harm to these assets, mishaps/misuses, vulnerabilities, abusers, hazards/threats, and safety/security risks
- **Defensibility Function/Subsystem Requirements**
  Functional/data/interface/quality Requirements specifying a defensibility function or subsystem
- **Defensibility (Safety/Security) Constraints**
  Architecture, design, implementation, integration, and configuration constraints specifying defenses (safeguards and countermeasures)

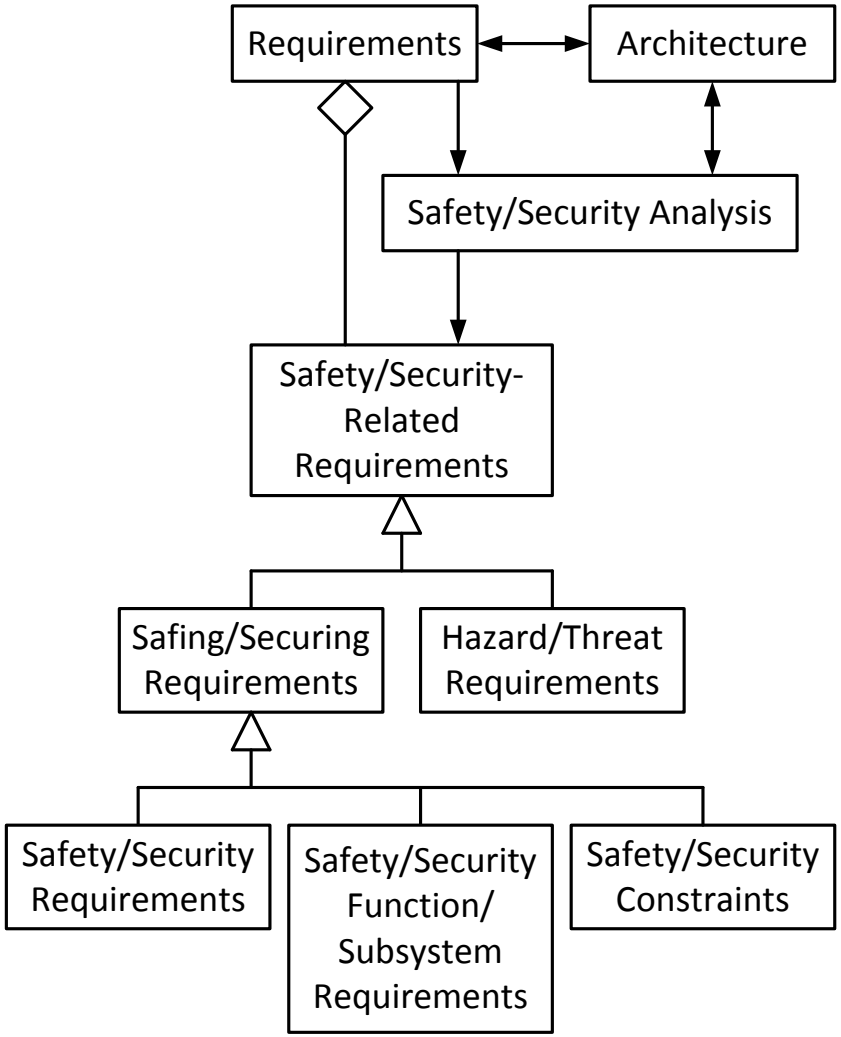
Dangerous (Hazardous/Threatening) Requirements

May make the system less safe or secure if not implemented right (Safety/Security Assurance Levels)

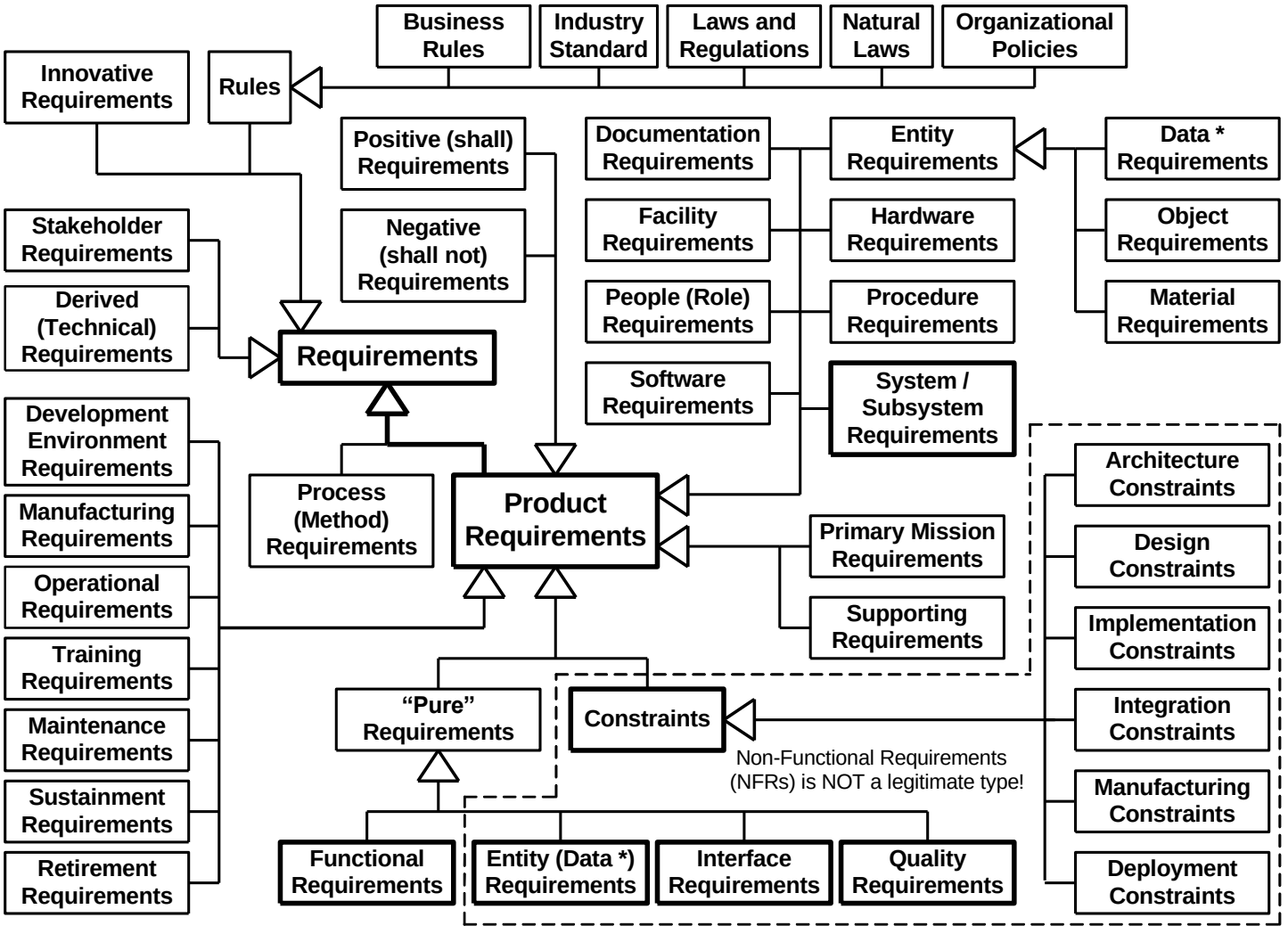
Types of Defensibility-Related Requirements (Safety- and Security-related Requirements)



Requirements, Architecture, and Danger (Safety/Security) Analysis



Types of Requirements



Conclusion

Top-level architecture drives safety/security analysis and vice versa.

Safety/security analysis drives safety-related requirements.

Safety/security engineering cannot be separate from requirements and architecture engineering.

- Safety/security engineering cannot be ignored until after requirements and architecture engineering.

Requirements, architecture, and hazard/threat analysis must be done incrementally, iteratively, and concurrently during the entire development and life cycle.

There are many types of requirements:

- There are several types of safety/security-related requirements.
- Many projects address only one or two of them.

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