National Institute of Standards and Technology NIST

Measuring and Assessing Software Trustworthiness: Approaches and Challenges

Elizabeth Fong
National Institute of Standards and Technology

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Presentation Outline

- **Overview of certification process model**
- **Selected Projects within Information Technology Laboratory, NIST as related to assessing trustworthiness of software**
  - **Software Metrics and Tool Evaluation (SAMATE)**
  - **Software Labels**
  - **Structured Assurance Case Methodology**
- **Challenges**

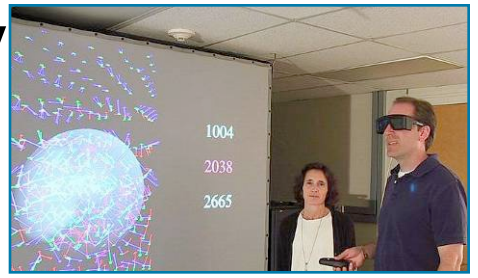
National Institute of Standards and Technology
Information Technology Laboratory

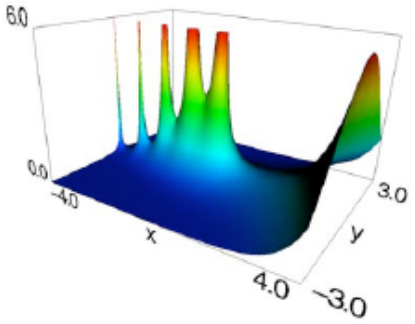
To promote US innovation and industrial competitiveness by advancing

measurement science, standards, and technology

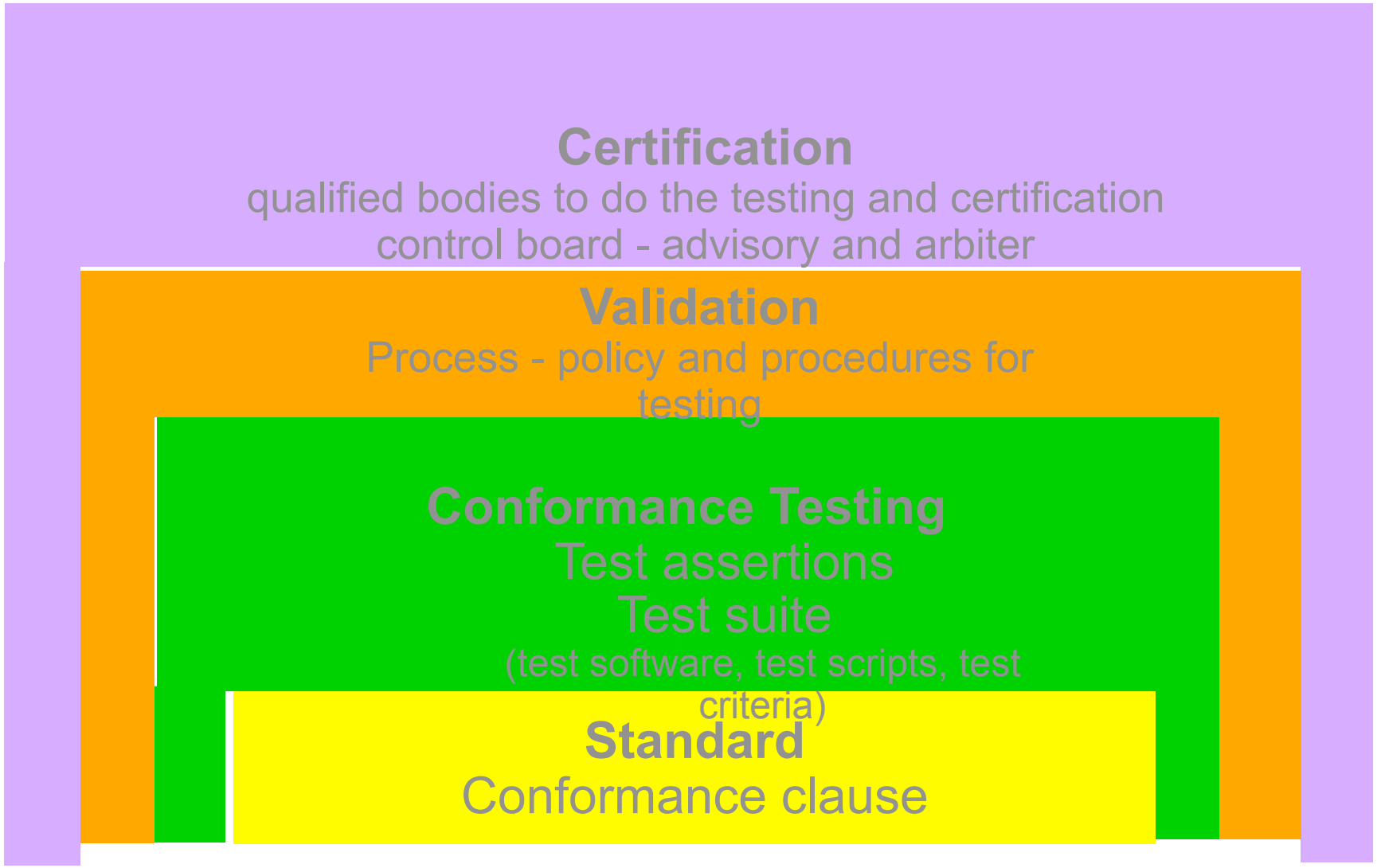
through research and development in

information technology, mathematics, and statistics





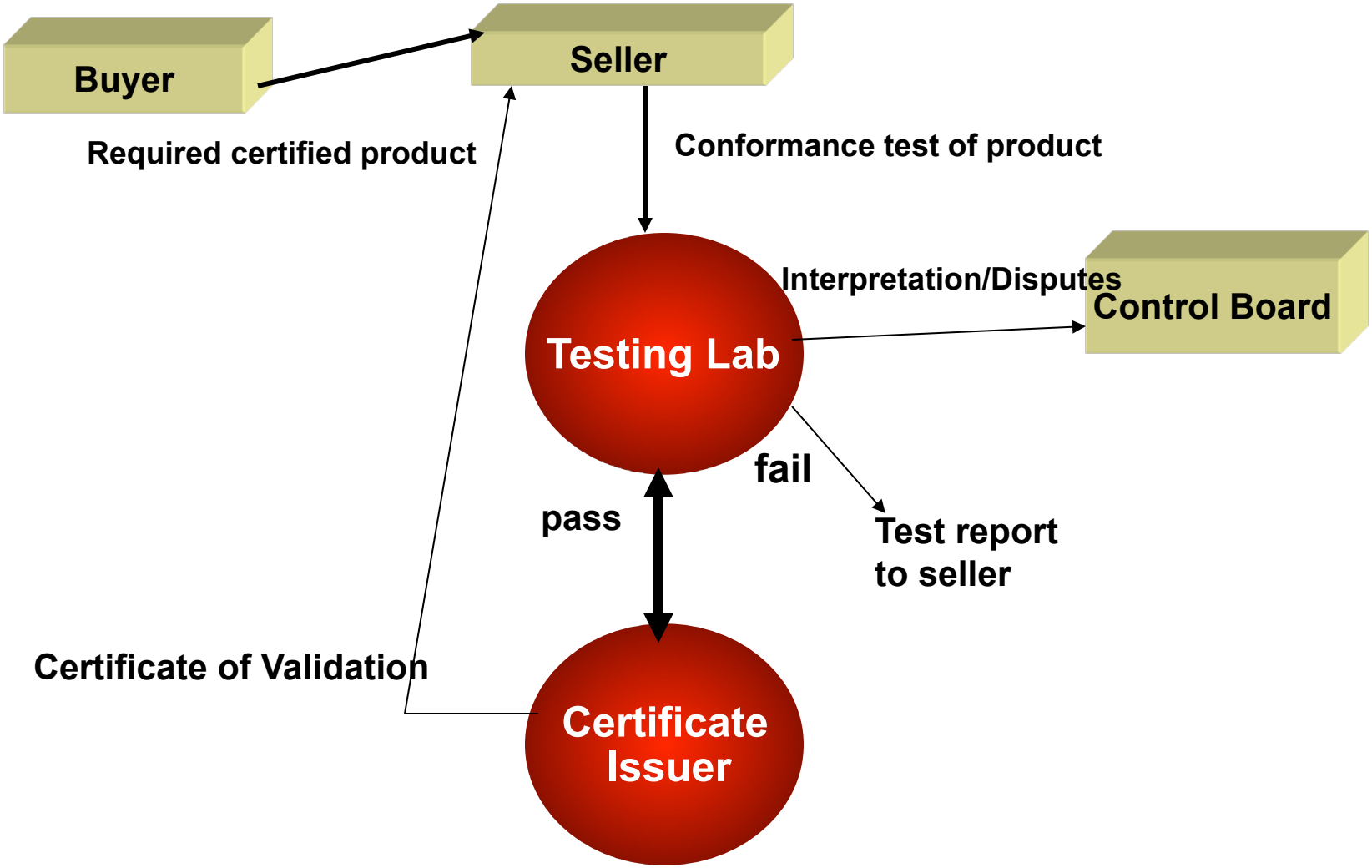
Certification Process Components



Certification Regimes

- Self certification
- Vendor declared rating system
- 3rd party certification

Validation & Certification Process Flow



SAMATE Overview

- Research and Measurement Opportunities
  - Test and measure the effectiveness of SwA tools
  - Standard definitions for software weaknesses
  - Identify gaps in tools and methods and needed research
- Major subtasks
  - Static source code security analyzers
  - Static Analysis Tool Exposition (SATE)
  - Studies on tool contribution to assurance
  - Web application scanners
  - Vote tools evaluation methodology
  - Software labels

http://samate.nist.gov/

Software labels

Investigation into the feasibility of software fact labels

And

What information can help the software buyer decide which product is better or more secure

Audiences and Scope

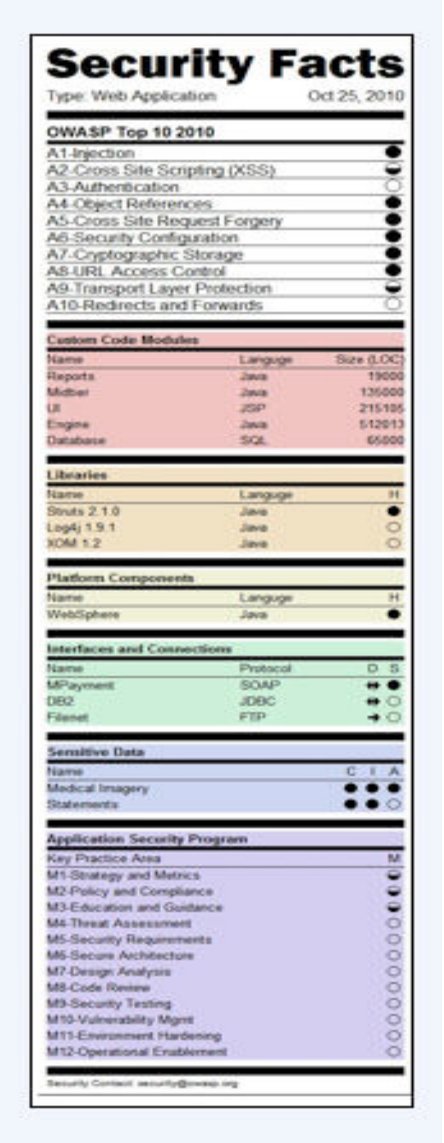
- Small businesses (dentist, drycleaners, accountant, plumber, restaurant)
- Integrators (mission critical systems)
- Naïve home users (my brother)

Software Rating Systems

- No standards
- Common criteria
- Due diligence questionnaires
- Rating for security and quality by some software assurance tools
  - OWASP application security verification standards
  - Veracode security rating system
  - Coverity software integrity rating

Software Label

- Software Facts should be:
  - Voluntary
  - Absolutely simple to produce
  - In a standard format for other claims
- What could be easily supplied?
  - Source available? Yes/No/Escrowed
  - Default installation is secure?
  - Accessed: network, disk, ...
  - What configuration files? (registry, ...)
  - Certificates (e.g., "No Severe weaknesses found by CodeChecker ver. 3.2")
- Cautions
  - A label can give false confidence.
  - A label shut out better software.
  - Labeling diverts effort from real improvements.



Trustworthy Software

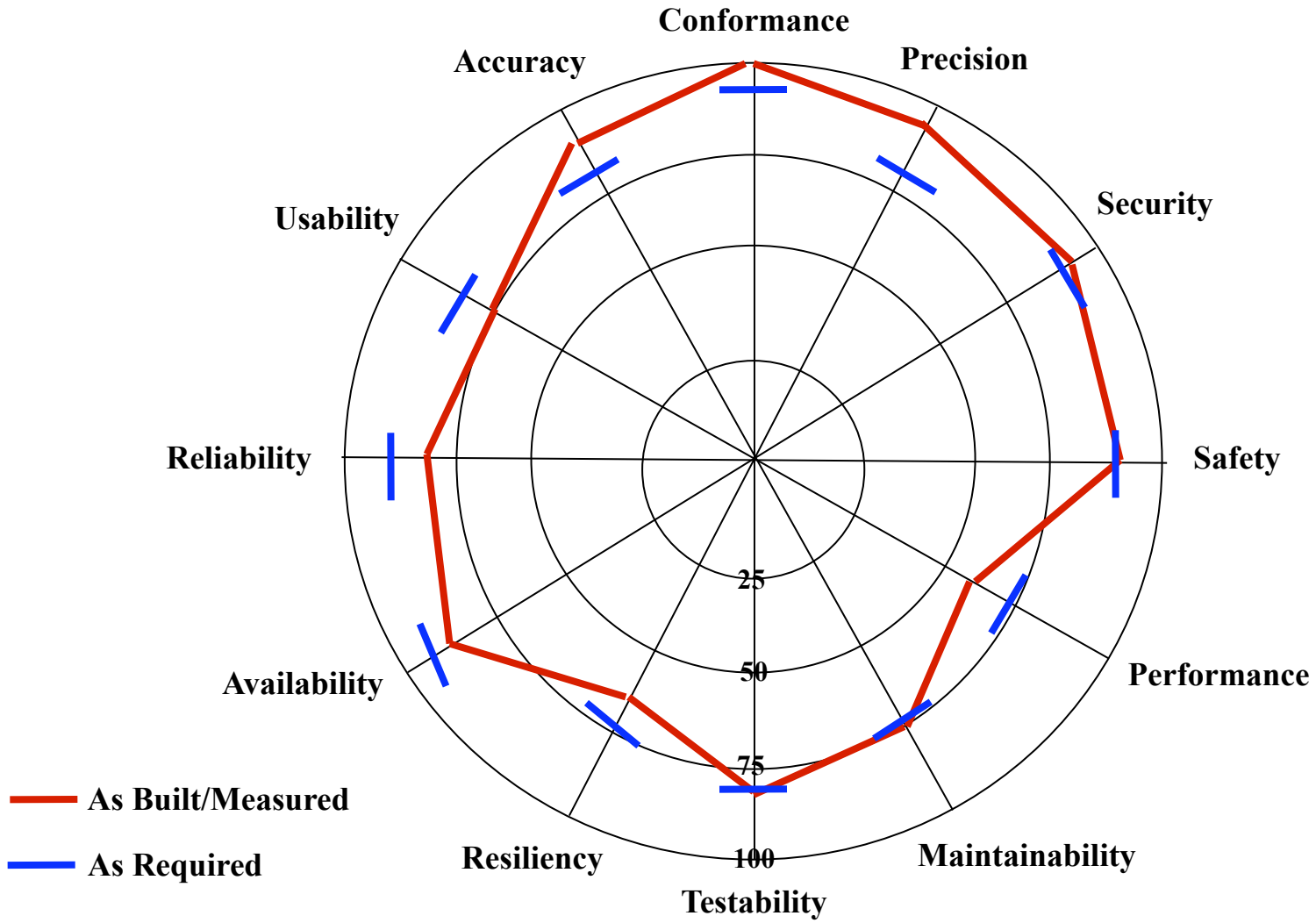
Software system that performs as intended for a specific purpose, when needed, with operational resiliency, and without unwanted side-effects, behaviors, or exploitable vulnerabilities.

Is trustworthiness of software measurable?

Assumptions:

- Software trustworthiness is composed of many attributes, i.e., security, reliability, availability, etc.
- Each attribute can be individually measured under constraints/conditions e.g. operational context.

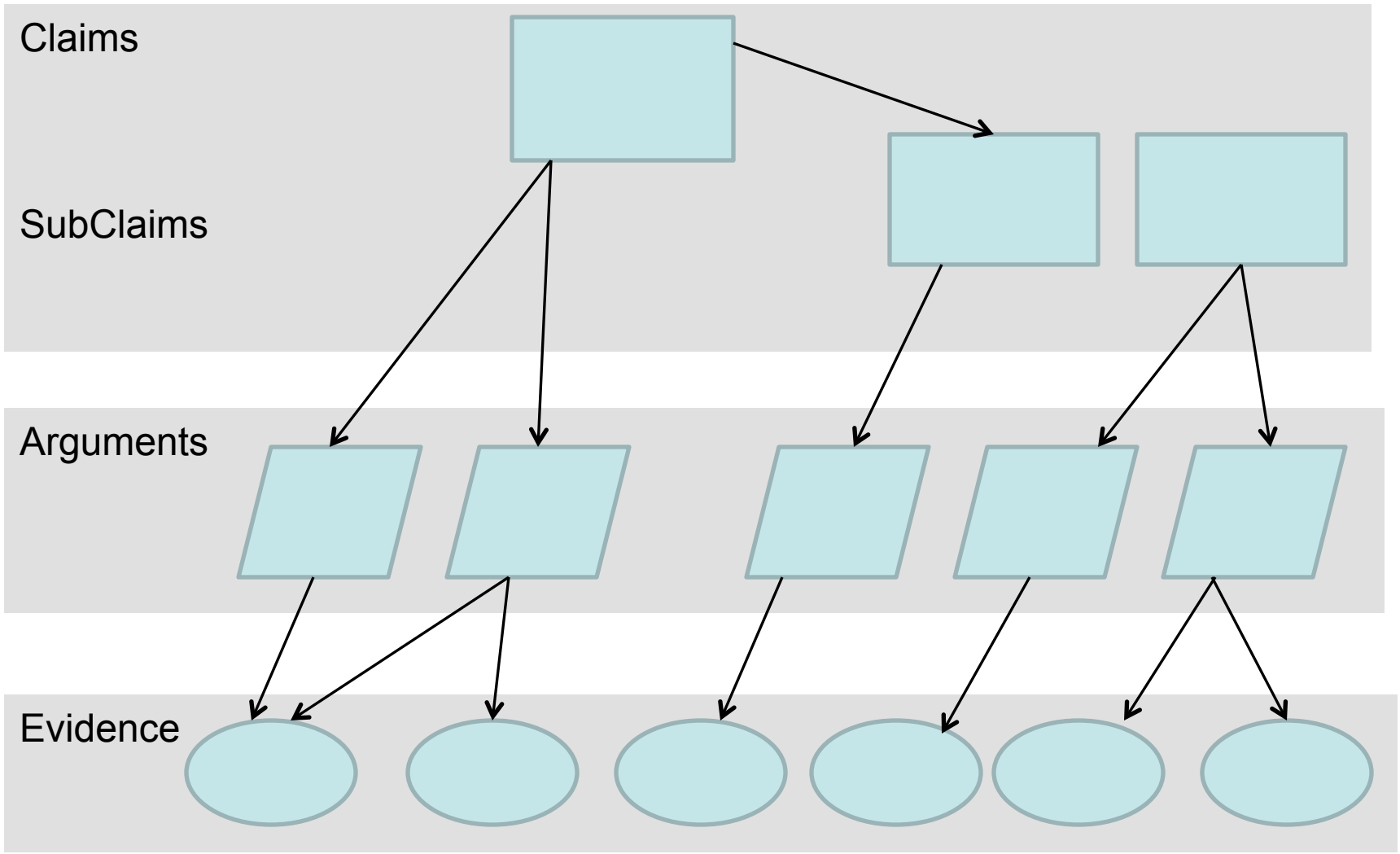
Concept of Trustworthy Software Index



Measuring and Assessing Software for Trustworthiness

- Develop argumentation models of trustworthiness based upon assurance claims, arguments and evidence (an "assurance case model")
- Conduct research into the composability models of trustworthy software characteristics (safety, dependability, security, reliability, etc.)

Assurance Case Structure



Use Structured Assurance Case Methodology as Certification Process

- **Provides a product-focused perspective into the attributes of the software system**

  - Not a compliance-driven view (i.e. not a "checklist", such as Common Criteria specifications)

  - Graphical notation improves analysis

  - Argumentation and evidence helps explain why you believe a product's attribute is assured

  - Provides traceability between assurance claims and evidence

Challenges

- How to provide a “measure” of trust to software based on uncertainty analysis
- Software supply chain risk management