



Visual Analytics for Requirements-driven Risk Assessment

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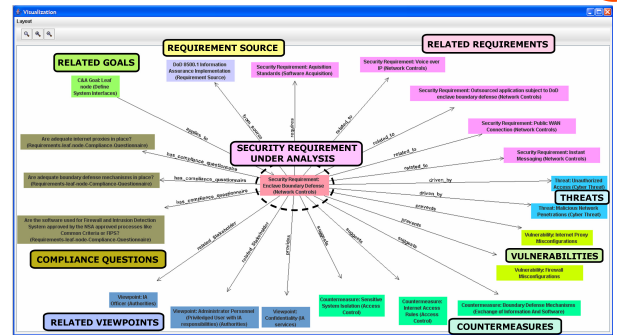
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1 The Position

- ▶ **Requirements Visualization** plays an important role in dealing with the complexities from
 - ▶ Numerous Dependability Requirements
 - ▶ Software-intensive Systems
 - ▶ Socio-technical Environments
- ▶ **Visual Analytics for Requirements** is the creation of abstract *visual metaphors* based on quantitative and qualitative requirements metrics that help to systematically reason about the related software behavior in a large information space

Multi-dimensional Requirements Visualization

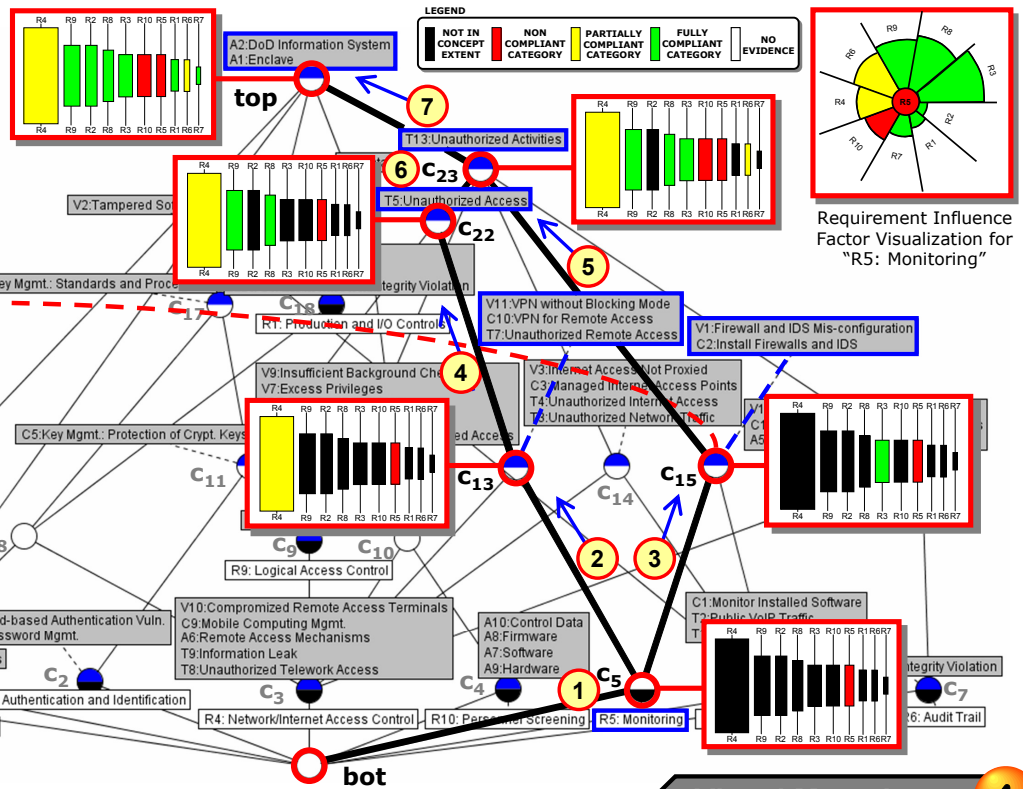
2



3 Visualizing Non-compliance Impact Analysis for Risk Assessment

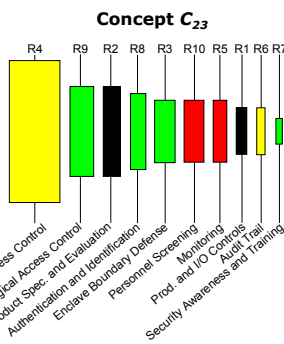
- ▶ **Step 1 (Localization):** Locate the most specific formal concept that characterizes the non-compliant requirement categories (**Concept C₅** for "R5: Monitoring" labeled as 1)
- ▶ **Step 2 (Traversal):** The impact of non-compliance is gradually propagated at higher levels of abstraction in the concept lattice. (Paths labeled as 2, 3, 4, 5, 6, & 7)

Concept C₁₅ Explanation:
To assess the risks related to the **Threats** of **Unauthorized Activities** that can **damage** the **Asset** of **Enclave** within a **DoD Information System** by **exploiting** the **Vulnerabilities** of **Firewall and IDS Mis-configuration**, collectively evaluate the compliance levels of **C&A requirements** in the categories of **Enclave Boundary Defense** and **Monitoring** for estimating the effectiveness of the **suggested Install Firewall and IDS with appropriate configurations** **Countermeasure** by these requirements to mitigate the **Vulnerabilities**



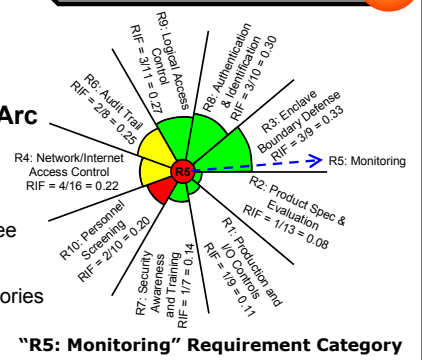
▶ Cohesive Bar Graph

- ▶ **Visualization Context:** Formal Concept
- ▶ **Visual Features of a Bar**
 - ▶ **Color:** Requirement category presence and compliance level
 - ▶ **Height:** Requirement category correlation index
 - ▶ **Width:** Risk coverage of a requirement category
 - ▶ **Order:** Relative criticality



▶ Cohesive Arc Graph

- ▶ **Visualization Context:** Requirement Category
- ▶ **Visual Features of an Arc**
 - ▶ **Color:** Requirement category compliance level
 - ▶ **Arc Radius:** Requirement influence factor is the degree of similarity between two requirement categories in correlating with other categories in the given scenario



5 References

▶ Gandhi, R.A., Lee, S.W.: Discovering and Understanding Multi-dimensional Correlations among Certification Requirements with application to Risk Assessment, India, RE 07

▶ Lee, S.W., Gandhi, R.A.: Requirements as Enablers for Software Assurance, CrossTalk: The Journal of Defense Software Engineering, December Issue, 19(12), 2006, pp. 20-24.