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Secure Software Modeling Methods for Forensic Readiness

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Content

- What Is Forensic Readiness?
- Forensic Readiness Concerns
- Forensic Readiness Concerns Meets Security
- Security Modeling Methods for Forensic Readiness

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What Is Forensic Readiness?

What is Forensic Readiness?

- Definition by J. Tan (2001)
  - Maximizing the usefulness of incident evidence data
  - Minimizing the cost of forensics during an incident response
- Systematic preparation for forensic investigation
- Proactive measures
  - Opposed to actual investigation, which is reactive

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What is Forensic Readiness?

- Originally, a set of general guidelines

- Expanded in process-oriented approach
  - Collection of evidence
  - Handling of evidence
  - Presentation of evidence
  - Staff training
  - Escalation policies
  - Etc.

- Increases likelihood of successful investigation

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Forensic Readiness in Software Engineering

- Formulated by Pasquale et al. (2018)
- Prepare software system during its development
  - Forensic-by-design
- Support for:
  - Proactive evidence securing
  - Data provenance
  - Ensuring chain of custody
- Non-functional requirement

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Open Challenges For Software Engineering

- Representation
- Reasoning about
- Methods for engineering
- Verification
- Specific environments (e.g., IoT)

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Forensic Readiness Concerns

Forensic Readiness Concerns

- Availability
- Relevance
- Minimality
- Linkability
- Completeness
- Non-repudiation
- Data provenance
- Legal compliance

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Forensic Readiness Concerns Meets Security

- Partial overlap with security concerns
- Typically specialized applications of concerns
- Difference between technical and legal understanding
  - Both needs to be addressed

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Forensic Readiness Concerns Meets Security

- **Availability**
- Relevance
- Minimality
- Linkability
- Completeness
- **Non-repudiation**
- **Data provenance**
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Security Modeling Methods and Forensic Readiness

Security Modeling

- Model-Driven Security
- UML profiles
- Aspect-Oriented Modeling
- Domain Specific Languages

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Security Modeling Methods

Method	Domain	Approach	Security concerns
UMLsec	General	UML profile	Integrity, Non-repudiation
SECTET	Distributed workflows	UML profile	Integrity, Non-repudiation
AOMsec	General	AOM, UML profile	Integrity
Sec@Runtime	General	AOM, UML	Integrity
SecureDWs	Data Warehouses	UML profile	Integrity, Non-repudiation, Auditing
ModelSec	General	DSL	Integrity

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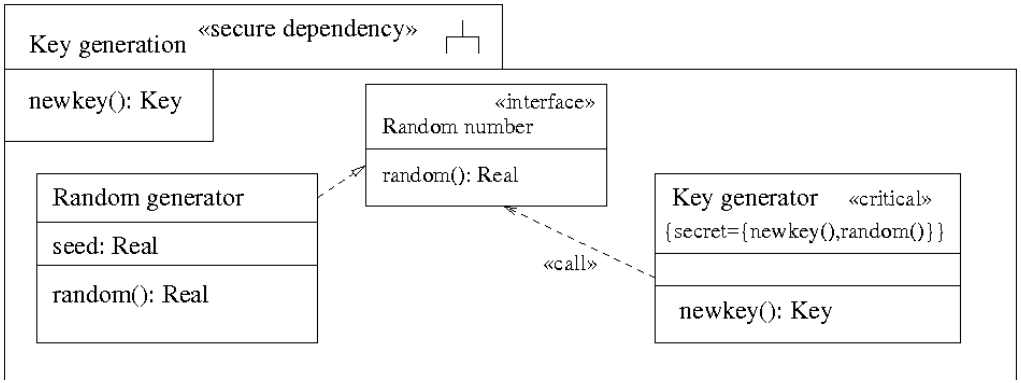
Security Modeling Methods

- UMLsec
  - Mature
  - General-purpose
  - Object level support
  - Verification



- SECTET
  - Aimed at distributed workflows
  - Relevant concerns defined at messaging level

Jürjens, J. (2002) 'UMLsec: Extending UML for Secure Systems Development', «UML» 2002 — The Unified Modeling Language, Berlin, pp. 412-425.

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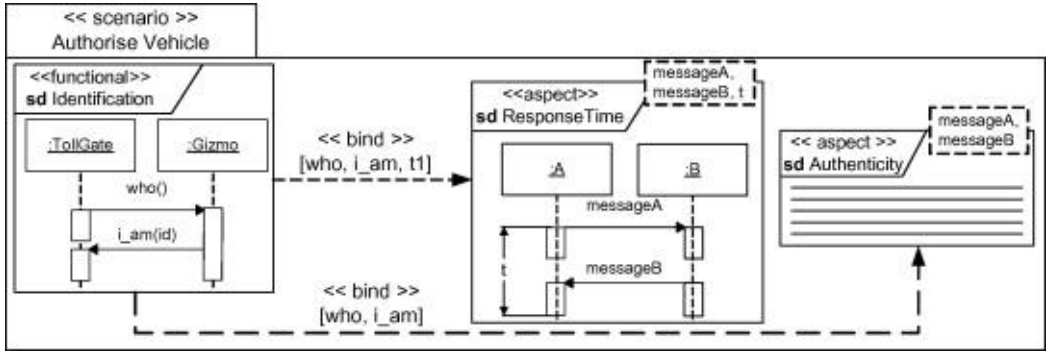
Security Modeling Methods

- AOMsec
  - Separation of concerns
  - Textual specification
- Sec@Runtime
  - Aspect-oriented
  - Runtime weaving
  - Dynamic adaptation



Sánchez, P., Moreira, A., Fuentes, L., Araújo, J. and Magno, J. (2010)
'Model-driven development for early aspects', *Information and Software Technology*, vol. 52, no. 3, pp. 249-273

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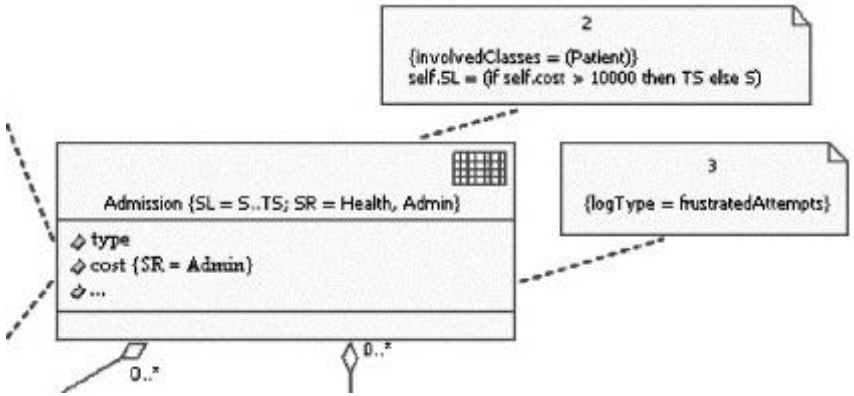
Security Modeling Methods

- SecureDWs
  - Aimed at Data Warehouses
  - Tackles auditing
- ModelSec
  - Chain of models
  - Generation of artifacts
  - Extendable meta-models



Fernández-Medina, E., Trujillo, J., Villarroel, R. and Piattini, M. (2007)
'Developing secure data warehouses with a UML extension'. Information Systems, vol. 32, no. 6, pp. 826-856.

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Conclusion

- Forensic readiness is about preparing for investigation
  - Yet unexplored in software engineering
- Secure modeling methods are promising in forensic readiness
  - There are overlaps in concerns
  - Although they are not directly applicable
  - They can be used as a basis for forensic readiness modeling

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