Developing secure applications with metrics in mind

Thomas Heyman, Christophe Huygens and Wouter Joosen

DistriNet, dept. of Computer Science
K.U.Leuven - Belgium

thomas.heyman@cs.kuleuven.be

How secure is my application?

- Our focus is on application security
  - White box (vs. black box)
- "How secure is my application?"
  = Do security requirements still hold?

☑ Measuring if security mechanisms work as intended

☐ Not measuring, e.g., #blocked intrusion attempts

Measuring (application-level) security

1. Need a structured repository of metrics
   - Collect time-tested metrics
2. Need a framework for measuring
   2.1. Facilitating selection at development time
   2.2. Aggregate/interpret according to security objectives

Outline

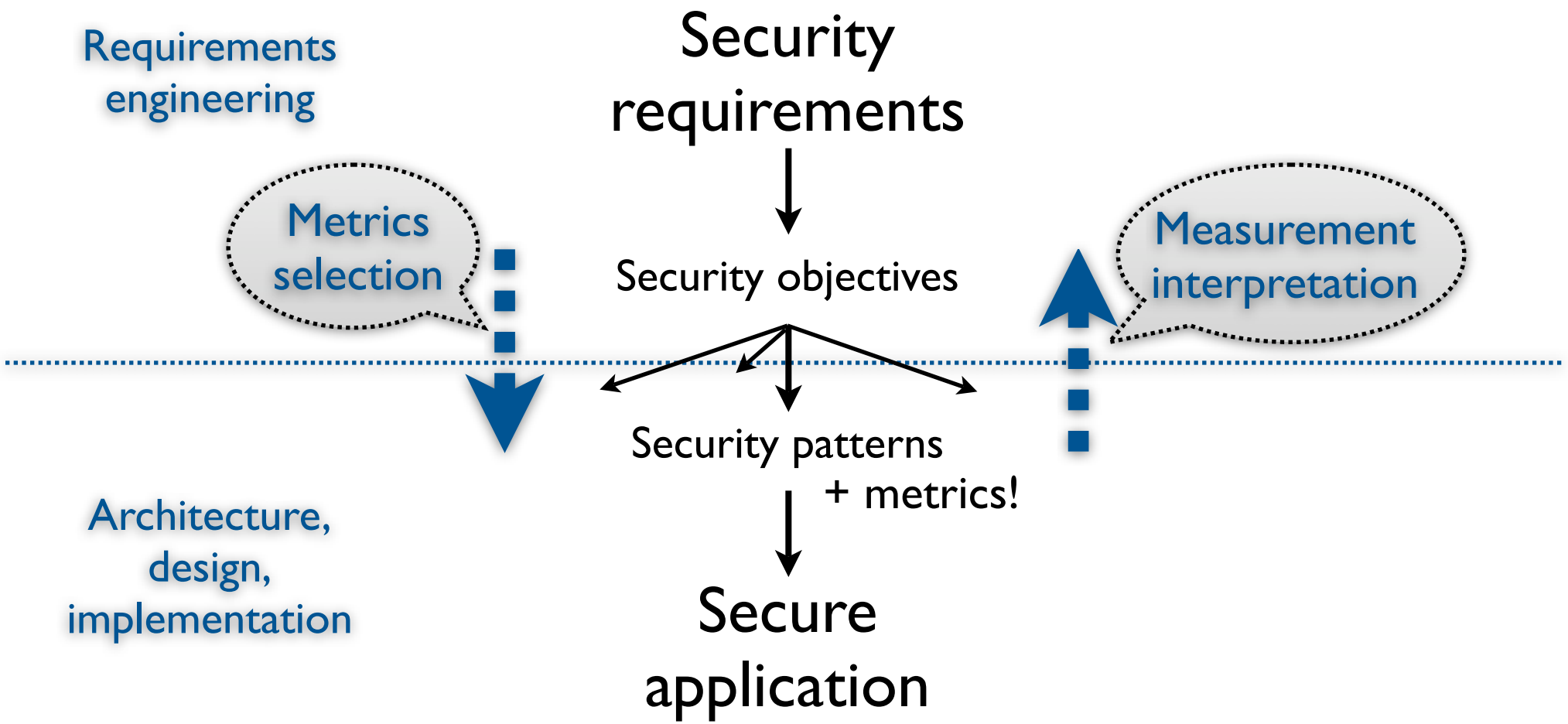
- Problem: how secure is my application?
- Our solution
  - Associating metrics to security patterns [1]
  - Instantiate metrics through security patterns [2.1]
  - Interpret measurements during production (or development) [2.2]
- Conclusion and future work

Associating metrics to security patterns [1]

- Security patterns:
  - Package domain-independent knowledge and expertise
  - Reusable!
- Possible to attach security metrics to patterns [MetriCon1]
  - Ecosystem vs. core
- Use pattern selection to piggy-back metrics in the application

[MetriCon1] Software Security Patterns and Risk, T. Heyman and C. Huygens

Integrating metrics in the development cycle [2]

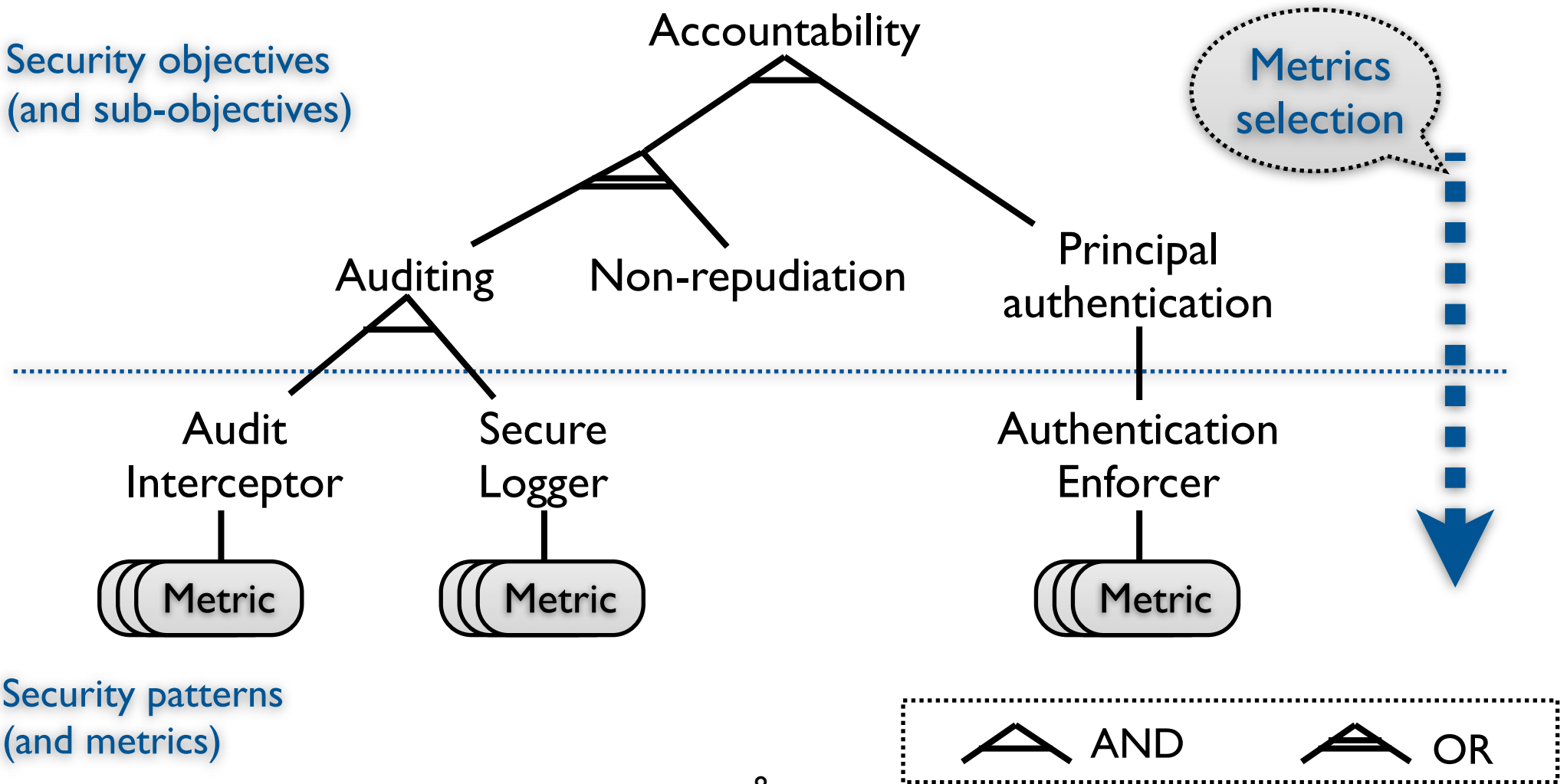


Metrics selection [2.1]

- Security requirements (domain specific) are assigned security objectives (domain independent)
- Select coherent set of security patterns to realise objectives (e.g., using [Yskout])
- Implement associated metrics

[Yskout] K. Yskout, T. Heyman, R. Scandariato, and W. Joosen,
A system of security patterns

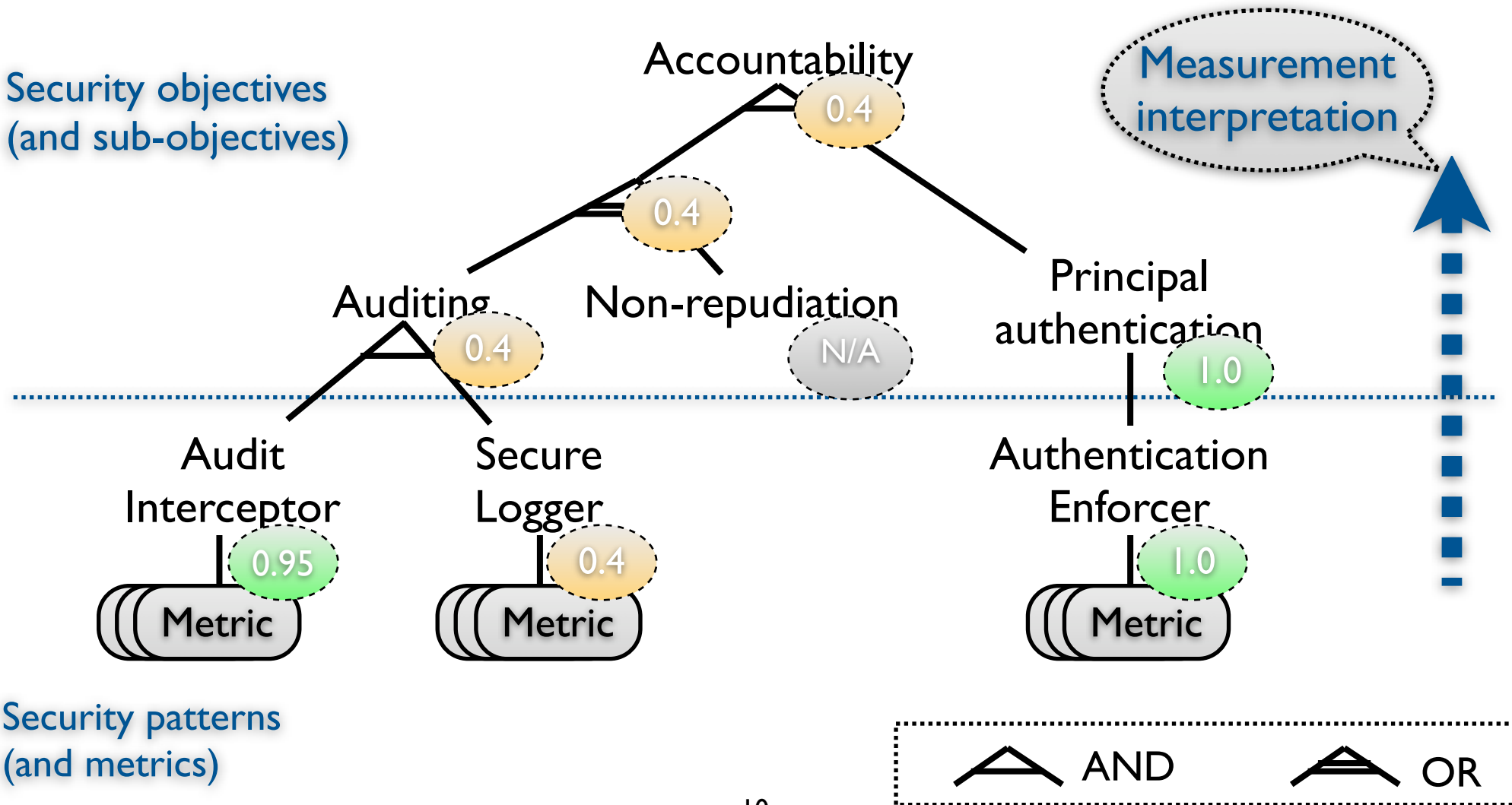
Metrics selection - illustration



Interpreting measurements [2.2]

- Use associated security pattern to aggregate measurements
  - Each pattern is instantiated for a certain security objective
    - E.g. Audit Interceptor provides Auditing
  - Patterns might depend on other patterns/objectives
    - E.g. Audit Interceptor depends on Secure Logger
- Combine measurements through resulting AND-OR-graph

Interpreting measurements - illustration



Conclusion

- A gap exists between:
  - high-level security requirements
    (i.e., what do stakeholders want)
  - production-level measurements
    (i.e., what is happening)
- Security patterns help to bridge this gap
  - Facilitates metric selection and instantiation
  - Enables aggregation of measurements to high-level indicators

Ongoing and future work

- Further validation: developing a PoC ATM system
- Perform sensitivity analysis on dependency graph
  - Identify “key indicators”, weak points
- Seamlessly integrate metrics in code (through AOP)
  - Automation?

Thank you!

Questions or remarks?

thomas.heyman@cs.kuleuven.be