A Common Process Model for Incident Response and Digital Forensics

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Motivation

- Analysis of digital evidence can put people into jail
- Only generally accepted, scientific methods should be applied in the analysis
- Frameworks for performing this analysis are called **process models**
- Different process models have emerged for different areas
- Can they be unified?

Examples: Incident Response and Digital Forensics

- Incident Response (IR): detect and contain computer security incidents
- Digital Forensics (DF): obtain valid evidence for (cyber)crime
- Highly related disciplines with a lot of overlap

- Aim: unified view of IR and DF using a Common Process Model

Agenda

- Background
  - Incident Response
  - Computer Forensics
- Common Model: Unifying IR and CF
- Summary and Discussion

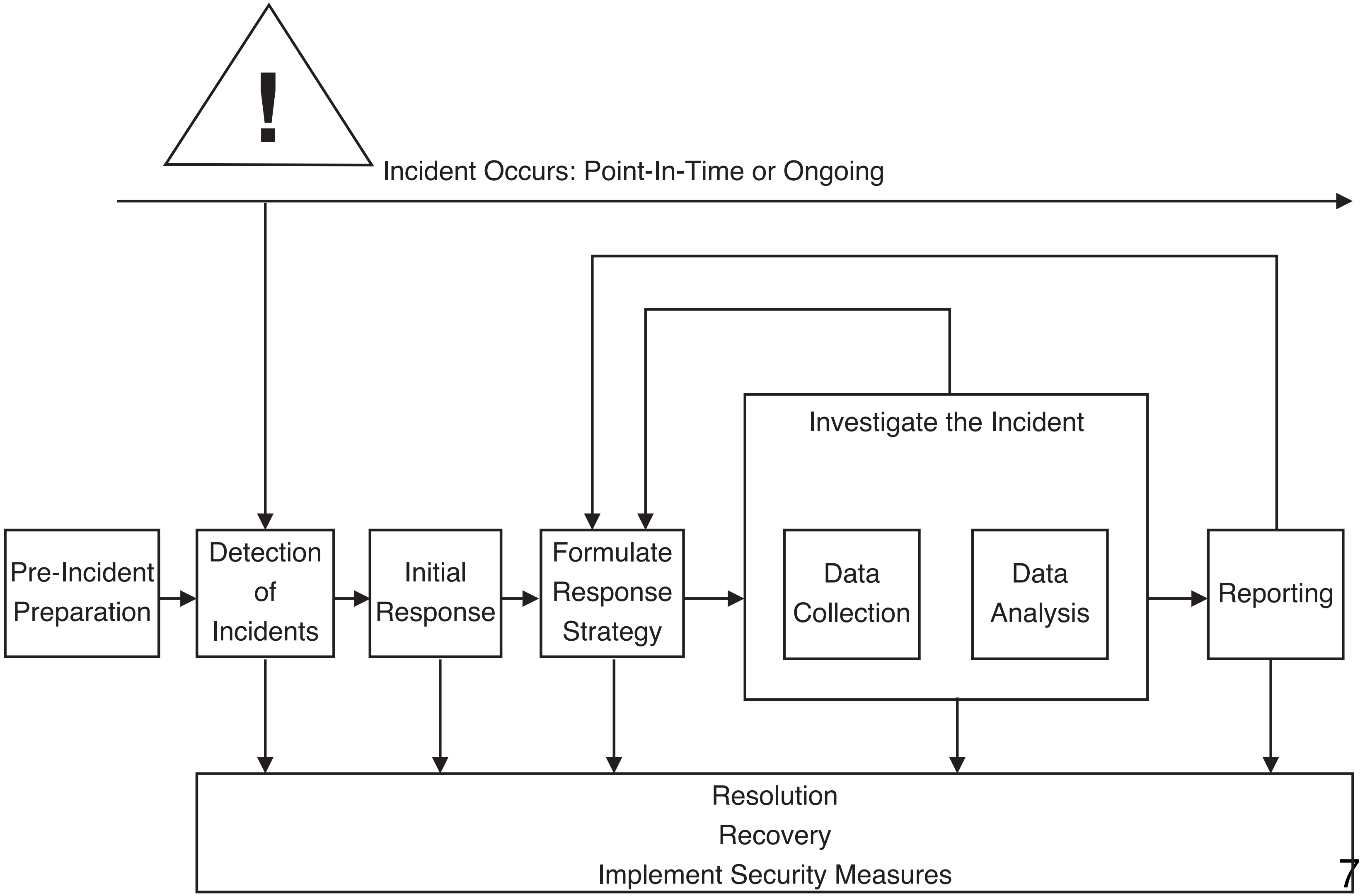
Background: Incident Response (IR)

- **Computer Security Incident** is a „violation or imminent threat of violation of computer security policies, acceptable use policies, or standard security practices." [NIST, Computer Security Incident Handling Guide]
- **Incident Response**: Detection and containment of computer security incidents
- Focus on quick remediation and return to day-to-day business
- Root cause analysis may be skipped to prevent costs, interruption of business, etc.
- Structured approach to IR process

IR Process Model

- Process model structures the investigation so that investigators make less errors
- Standard reference:
  - Kevin Mandia, Chris Prosise, Matt Pepe: Incident Response & Computer Forensics. 2nd Ed., McGraw-Hill, 2003.
- Process model of Mandia et al.
  - 7 phases ...

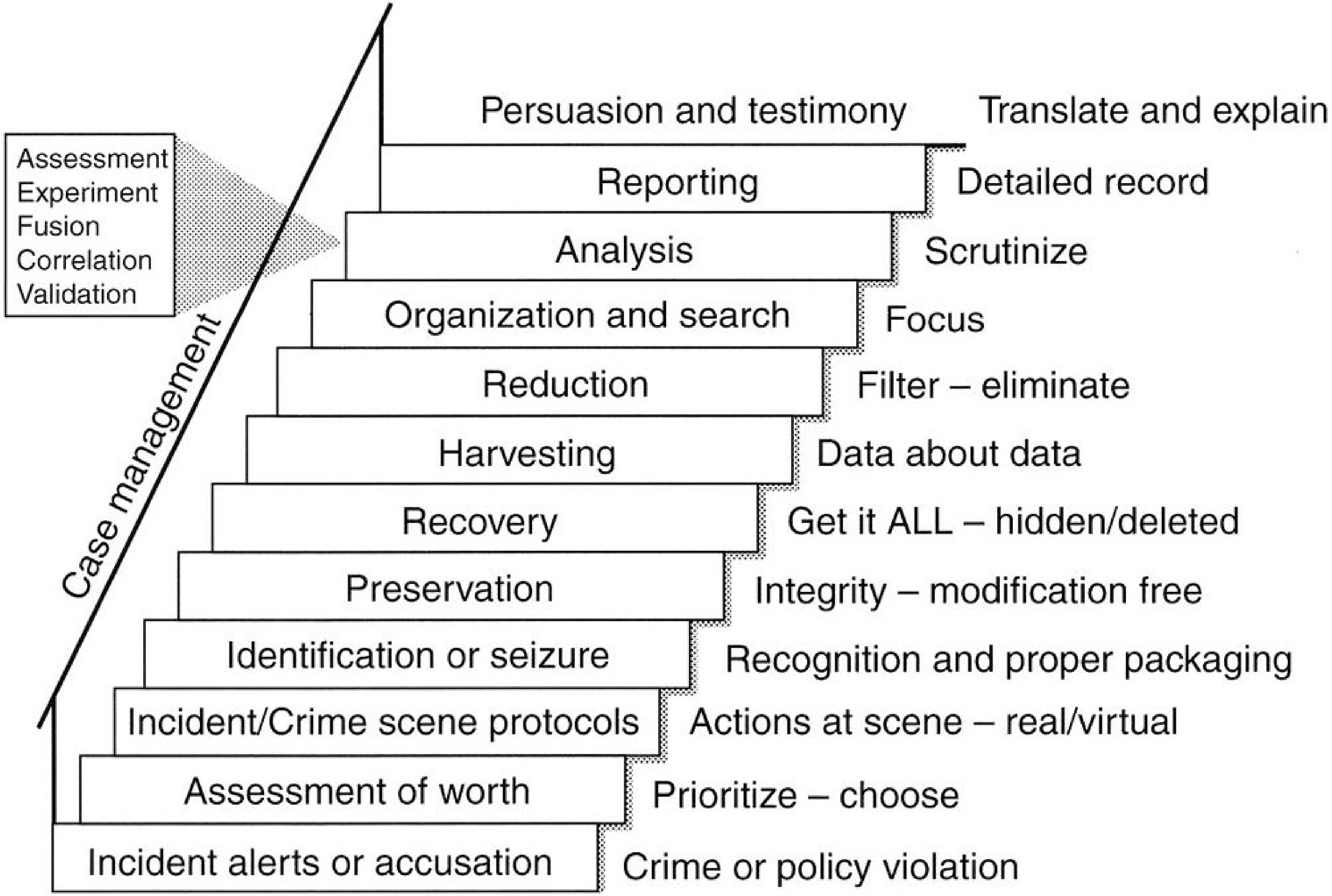
IR Process Model (Mandia et al.)



Background: Digital Forensics (DF)

- Part of forensic science: Obtain, analyze and present **digital evidence**
- Evidence handling suitable for a court of law
- Reliable, repeatable and well-documented methods for analysis
- Process model of Casey: **Investigative Process**
  - General model for digital investigations
  - Includes tasks of first responders
  - De facto standard
- Eoghan Casey: Digital Evidence and Computer Crime. 2nd Ed., Academic Press, 2004, Kapitel 4.
- 11 phases ...

Investigative Process Model



Assessment
Experiment
Fusion
Correlation
Validation

Case management

Persuasion and testimony	Translate and explain
Reporting	Detailed record
Analysis	Scrutinize
Organization and search	Focus
Reduction	Filter – eliminate
Harvesting	Data about data
Recovery	Get it ALL – hidden/deleted
Preservation	Integrity – modification free
Identification or seizure	Recognition and proper packaging
Incident/Crime scene protocols	Actions at scene – real/virtual
Assessment of worth	Prioritize – choose
Incident alerts or accusation	Crime or policy violation

Comparison: IR vs. DF

- IR puts focus on:
  - Management and quick containment of the security incident
  - Integration of investigation into the business processes of an organization
  - Usually quick return to service
- DF puts focus on:
  - Detailed and careful handling of digital evidenve and analysis
  - Scientific approach
- Orthogonal aspects

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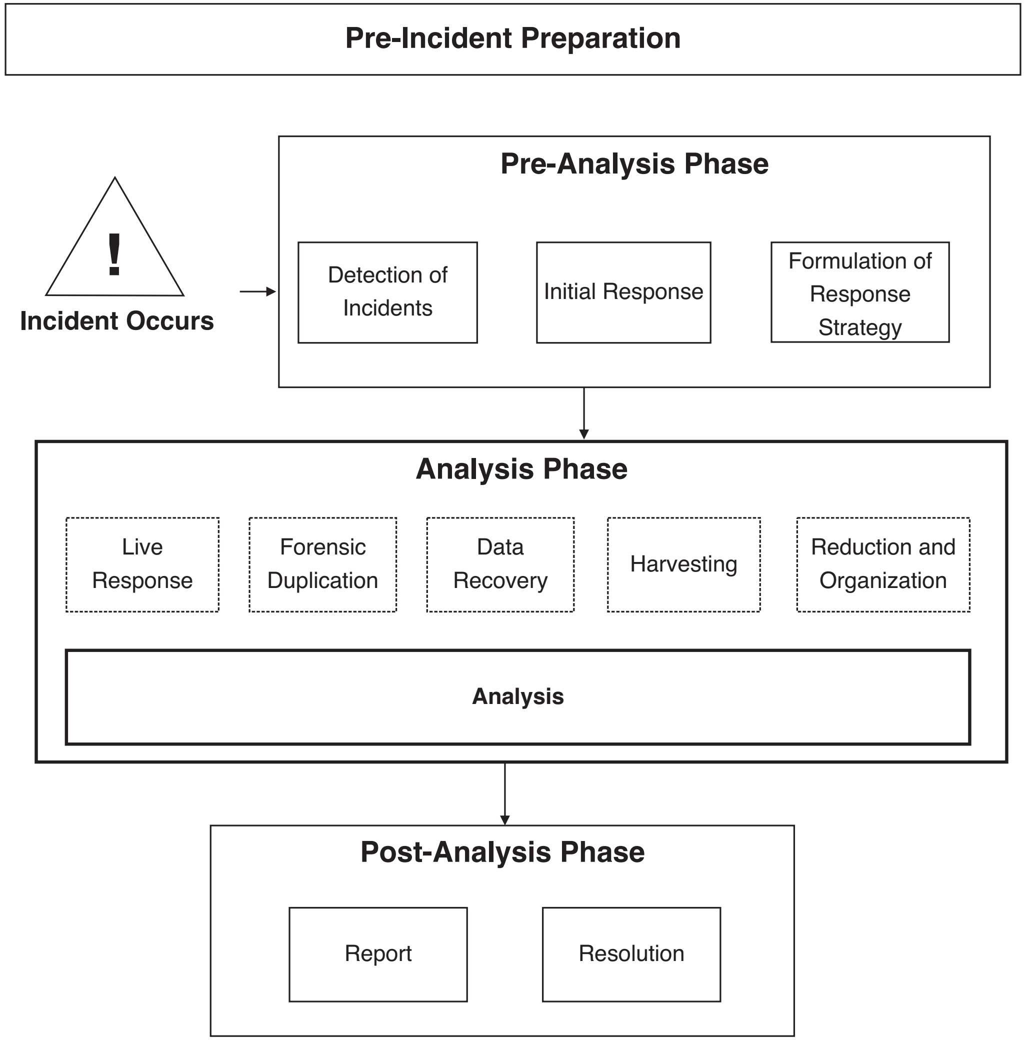
The Common Model (CM)

- Combine IR and DF processes:
  - Adds a management aspect to DF
  - Adds choice of suitable response strategy to DF
  - Adds option to conduct full-scale forensic analysis to IR

- Three phases to structure the response to a computer security incident
  - Pre-analysis phase
  - Analysis phase
  - Post-analysis phase

- Each phase divided into multiple steps
- Pre-Analysis phase determines depth of analysis phase

Common Model: Overview



Pre-Incident Preparation

Incident Occurs

Pre-Analysis Phase

Detection of Incidents

Initial Response

Formulation of Response Strategy

Analysis Phase

Live Response

Forensic Duplication

Data Recovery

Harvesting

Reduction and Organization

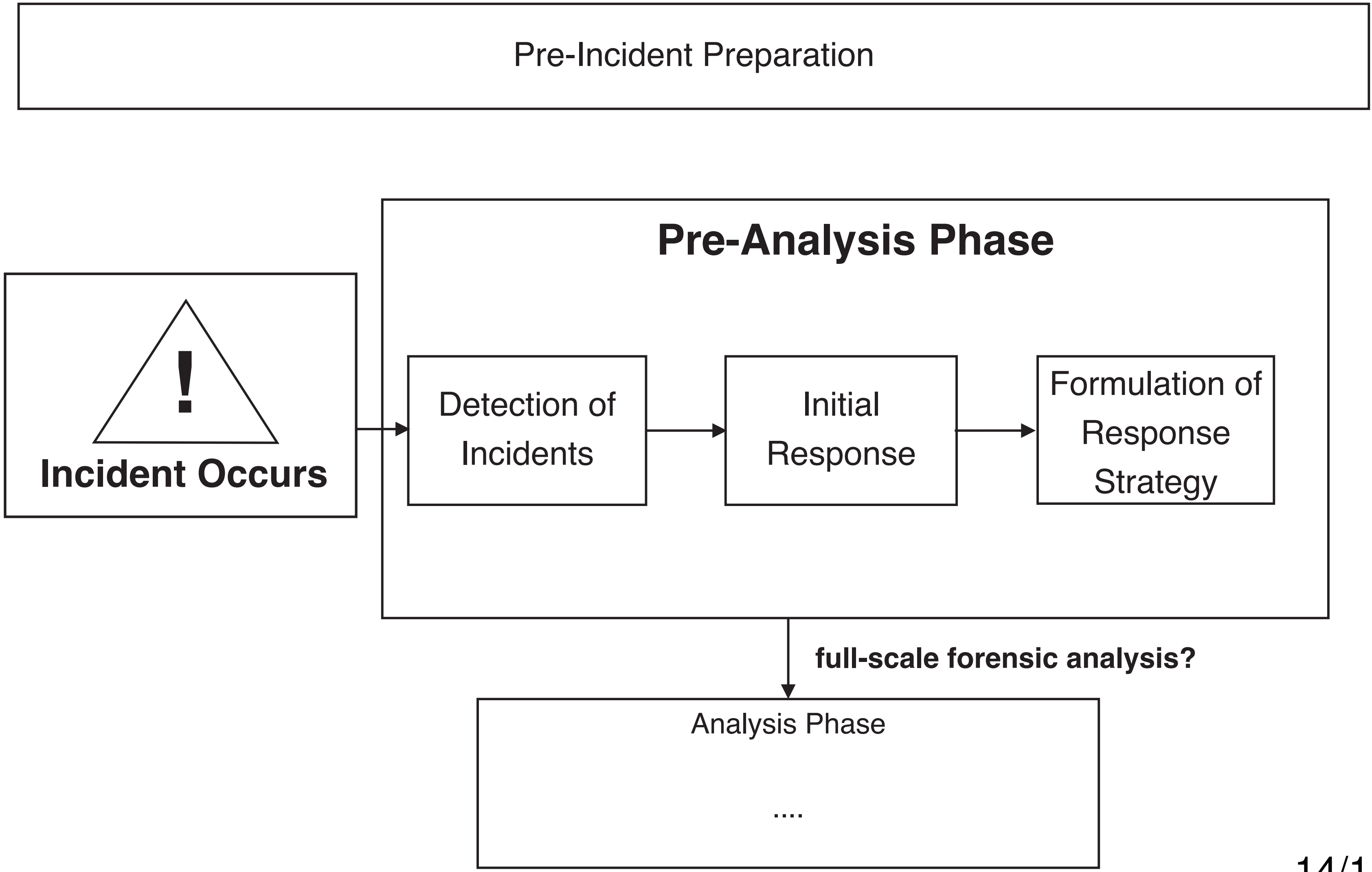
Analysis

Post-Analysis Phase

Report

Resolution

Pre-Analysis Phase


Pre-Incident Preparation

Incident Occurs

Pre-Analysis Phase

Detection of Incidents

Initial Response

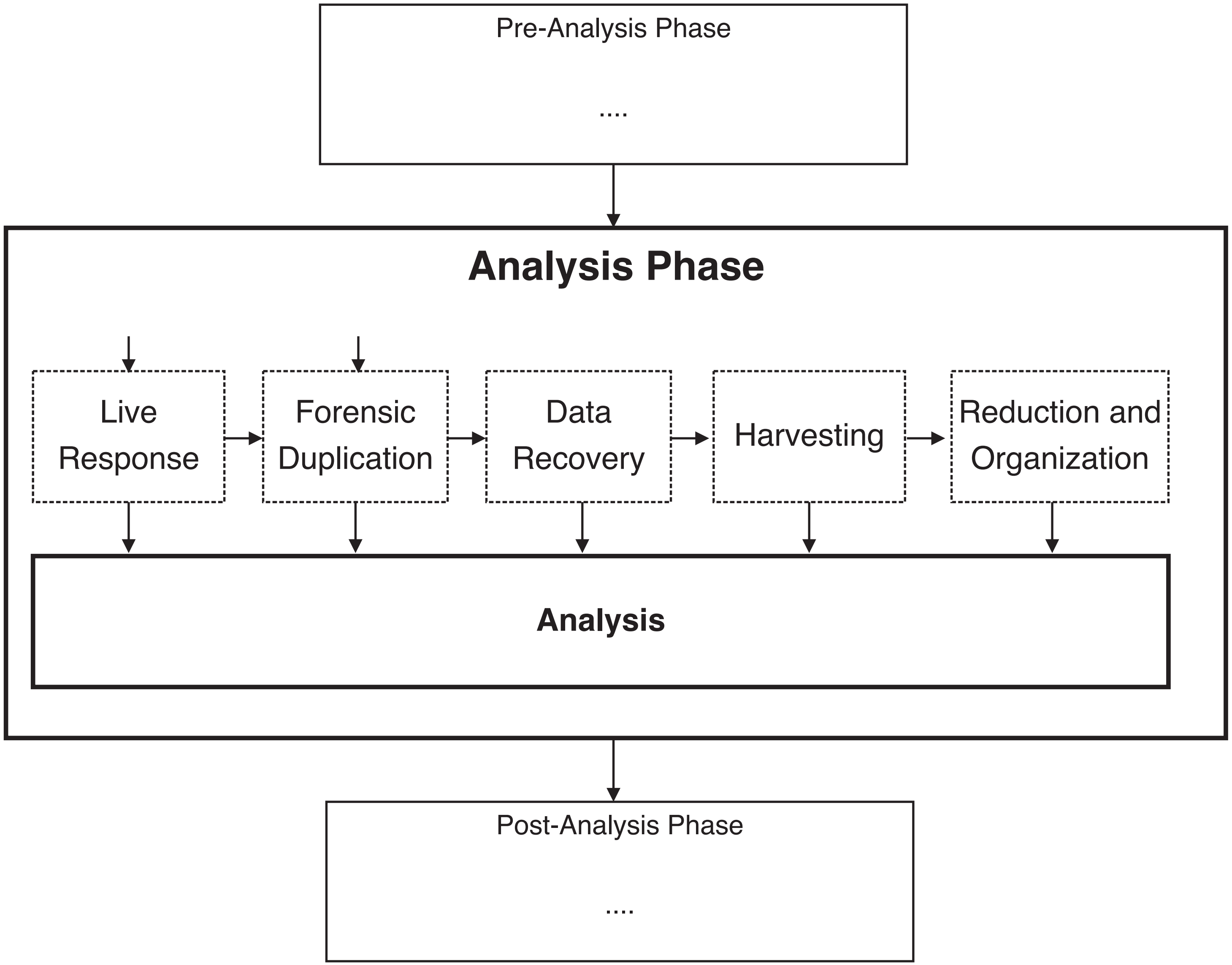
Formulation of Response Strategy

full-scale forensic analysis?

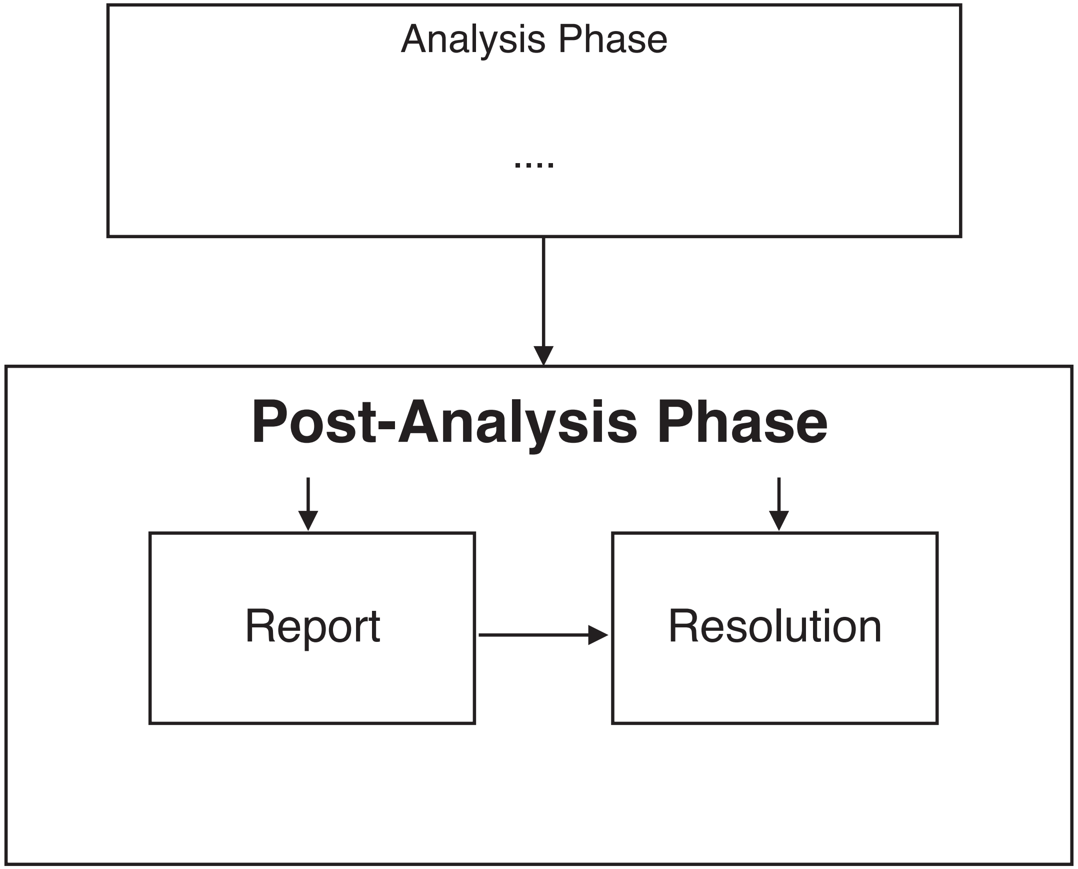
Analysis Phase

....

Analysis Phase



Post-Analysis Phase



Discussion (1/2)

- Unified view of IR and DF
- Flexible approach:
  - Takes organisational issues into account
  - Enforces scientific rigor where appropriate

- When to do a full-scale forensic analysis?
  - Hard factors:
    - Response posture: Does the organization follow a „zero tolerance" policy?
    - Legal constraints: Must the incident be communicated to the police?
  - Soft factors:
    - Attacker threat level: Does the attacker represent a great threat?
    - Potential damage: Is the expected damage large?

Discussion (2/2)

- Formalized criterion for soft factors:

  Attacker Threat Level x Potential Damage > X

- Similar to risk equation:

  Risk = Threat x Vulnerability x Cost

  - AttackerThreatLevel ~ Threat
  - Potential Damage ~ Cost
  - „Vulnerability = 1": incident has already occured

References

- Felix Freiling: Vorlesung Digitale Forensik. Frühjahrssemester 2007, Universität Mannheim, Chapter 4.
- `http://pi1.informatik.uni-mannheim.de/filepool/teaching/forensik-2007`
- Bastian Schwittay: Towards automating analysis in computer forensics. Diplomarbeit, RWTH Aachen, Department of Computer Science, 2006, Chapters 2 and 3. `http://pi1.informatik.uni-mannheim.de/filepool/theses/diplomarbeit-2006-schwittay.pdf`