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Preventive Digital Forensics: Creating Preventive Digital Forensics Systems to Proactively Resolve Computer Security Incidents in Organizations

JESUS RAMIREZ PICHARDO

(PMP, GCFA, GCFE, OPST, OPSA, ISO27001 Lead Auditor)

Co-author: JESUS VAZQUEZ GOMEZ, PhD

Outline

- Objective
- Context
- Problem Statement
- The Preventive Digital Forensics Methodology
- Case Study
- Conclusions

Objective

- Explain this work that complements the traditional Computer Forensics in the evidence acquisition phase.
- The following are crucial for the correct application of this work:
  - The maturity level of Information Security, Digital Forensics and Incident Response process.
  - The level of knowledge and control that the organization has on their critical IT services.

Context

- What is Computer Forensics?
  - Computer Forensics is the application of scientific and specialized analytical techniques to identify, preserve, analyze and present data that are valid in a legal proceeding.
  - When we speak of an unauthorized access to a system, Computer Forensics aims to determine who was the aggressor, where the attack came from, how it was managed to violate the system and what were his subsequent actions.

Context

- Goals of Computer Forensics
  - While it is very important to find the attacker, another important goal is to strengthen the security of the systems and networks involved applying lessons learned during the investigation.
  - Computer Forensics is *post mortem*, *ergo* it is reactive.
  - A new complementary approach: We can supplement the traditional Computer Forensics, to be prepared to provide digital evidence related to critical incidents most likely to occur (Preventive Digital Forensics).

Context

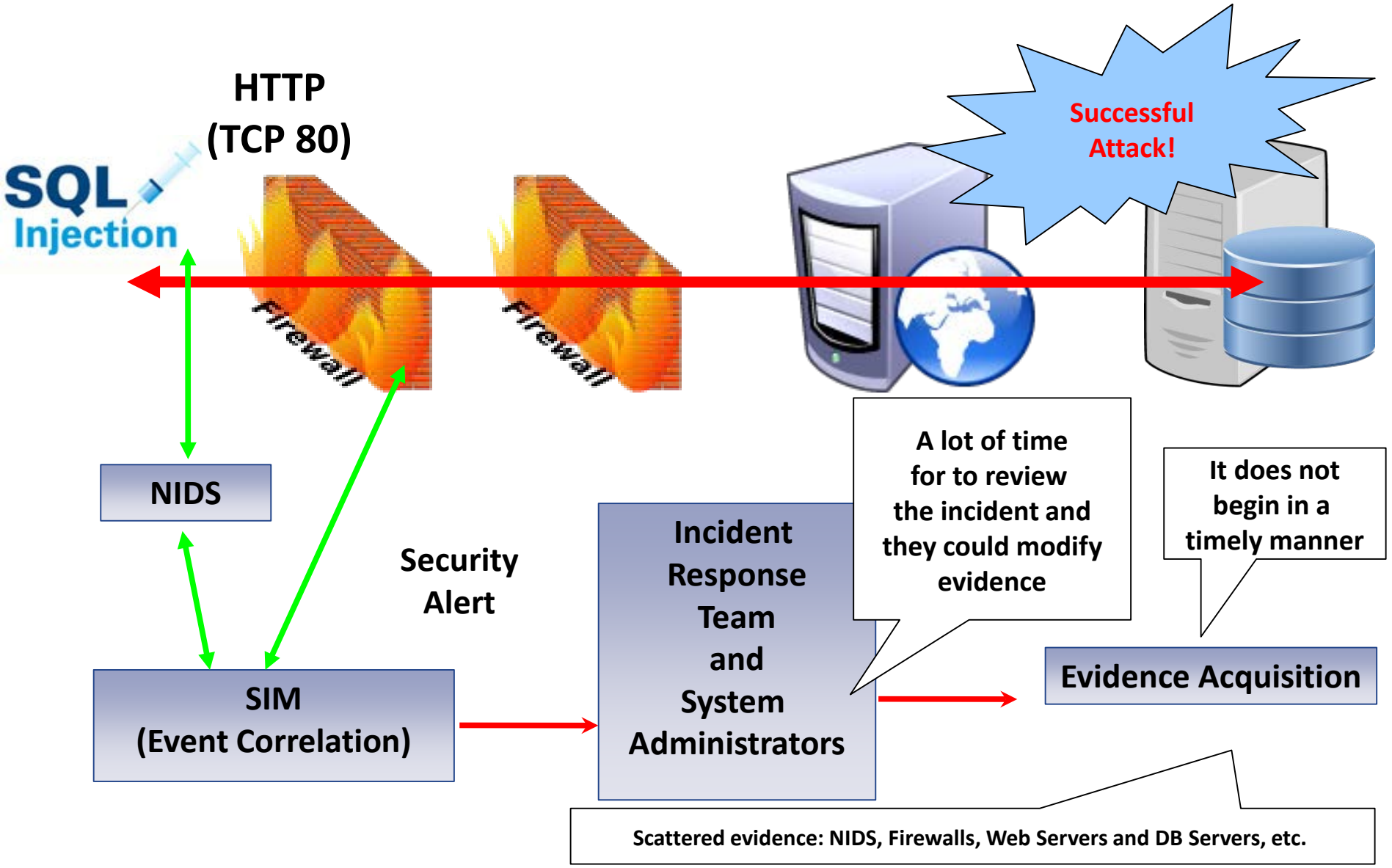
- There is not a single Computer Forensics Methodology, but they all share the following fundamental processes:
  1. Incident Response AND Evidence Acquisition
  2. Research and Analysis
  3. Report results
- This work focuses on the point No. 1.

Problem Statement

- Incident Response is the process of detecting and analyzing incidents and limiting the incident's effect.
- Then, the incident handlers will take actions to ensure that the progress of the incident is halted and that the affected systems and networks return to normal operation as soon as possible.

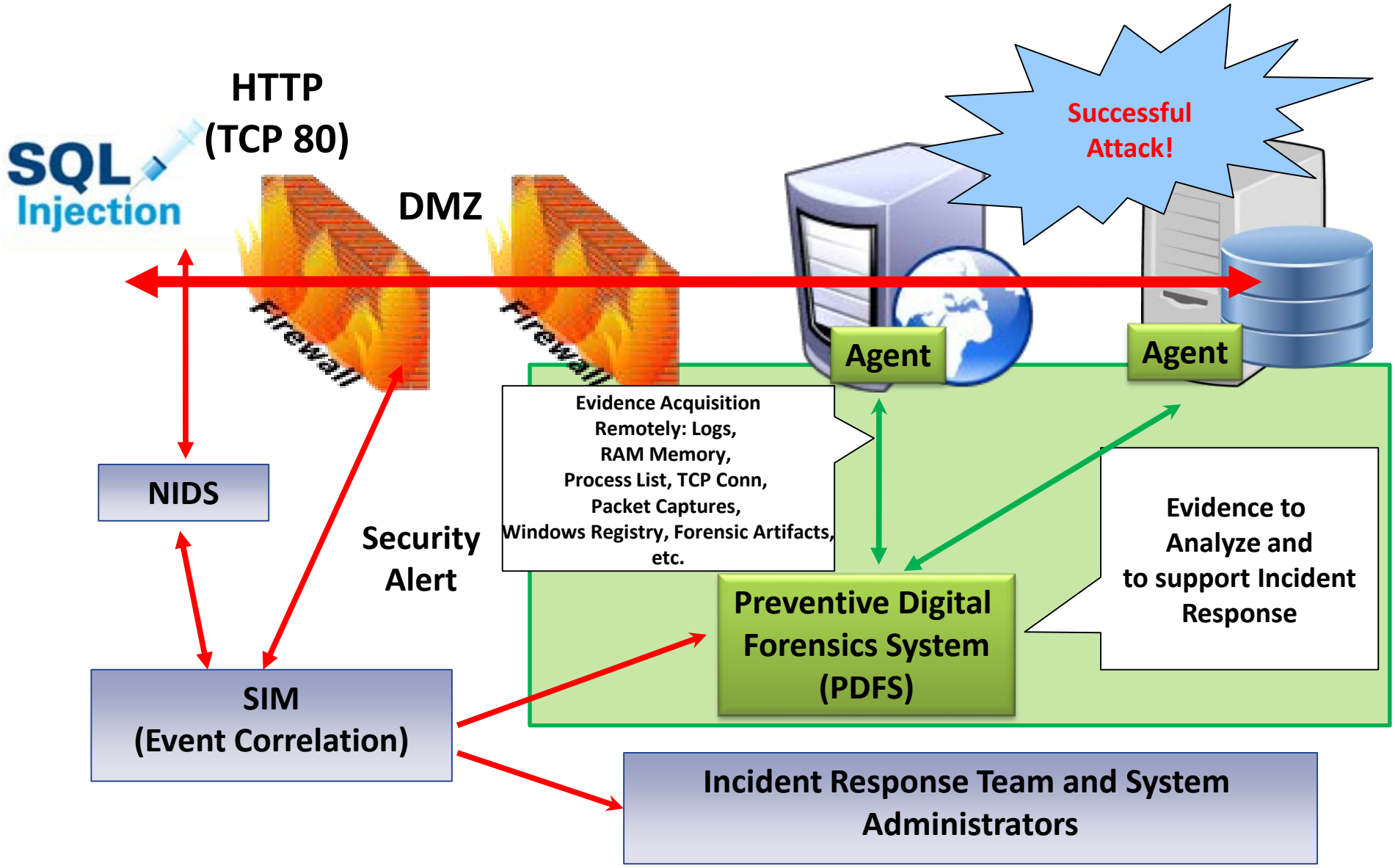
Problem Statement

- The actions to solve the incident could modify or destroy the evidence. When it is obtained, it could have been too late.
- On the other hand, it is difficult to obtain required information very quickly (high dispersion of data across affected systems and networks).


HTTP
(TCP 80)
SQL
Injection
Firewall
Firewall
Successful
Attack!
NIDS
Security
Alert
SIM
(Event Correlation)
Incident
Response
Team
and
System
Administrators
A lot of time
for to review
the incident and
they could modify
evidence
It does not
begin in a
timely manner
Evidence Acquisition
Scattered evidence: NIDS, Firewalls, Web Servers and DB Servers, etc.

Proposal

- Evidence Acquisition should be done:
  - simultaneusly with Incident Response,
  - in all affected systems and networks at the same time and in a timely manner,
  - whithout any modification of evidence.
- According to the above, I propose a “Preventive Digital Forensics System”: **If it is known which are the critical organizational systems and their information security risks** then, configure these systems in such a manner that they facilitate computer forensics.

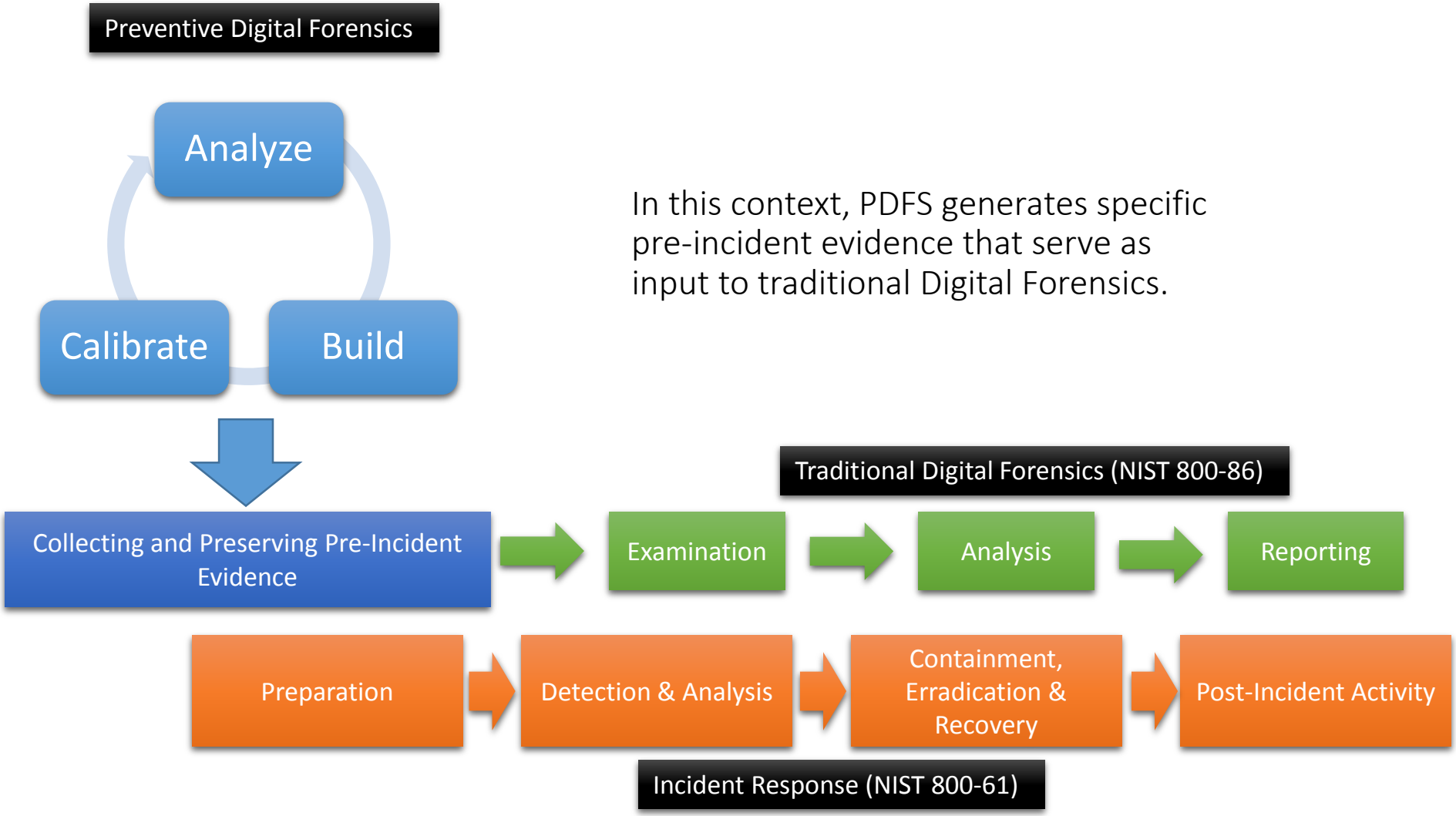

HTTP
(TCP 80)
SQL Injection
DMZ
Firewall
Firewall
Successful Attack!
Agent
Agent
Evidence Acquisition Remotely: Logs, RAM Memory, Process List, TCP Conn, Packet Captures, Windows Registry, Forensic Artifacts, etc.
NIDS
Security Alert
Preventive Digital Forensics System (PDFS)
Evidence to Analyze and to support Incident Response
SIM (Event Correlation)
Incident Response Team and System Administrators

The Preventive Digital Forensics Methodology

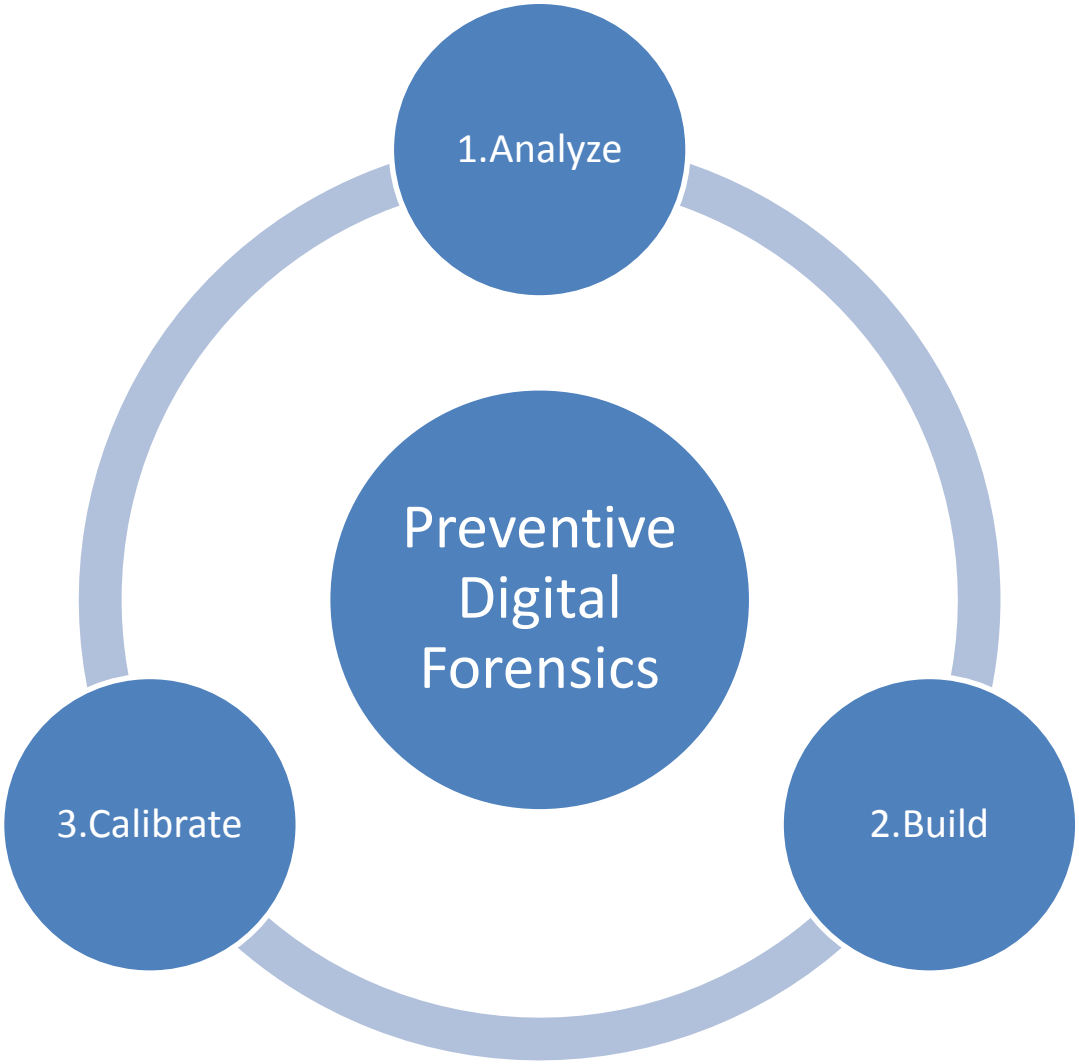
- It is based on experimentation, iterations and learning.
- It allows to design, to develop and to evaluate a set of digital forensic capabilities (PDFS) that will be implemented in organization's critical IT services such that they will facilitate digital forensic tasks, in order to discover and evaluate indicators of malicious behavior,
- and they will allow to give an effective response to computer security incidents in the shortest possible time and cost.

The Preventive Digital Forensics Methodology

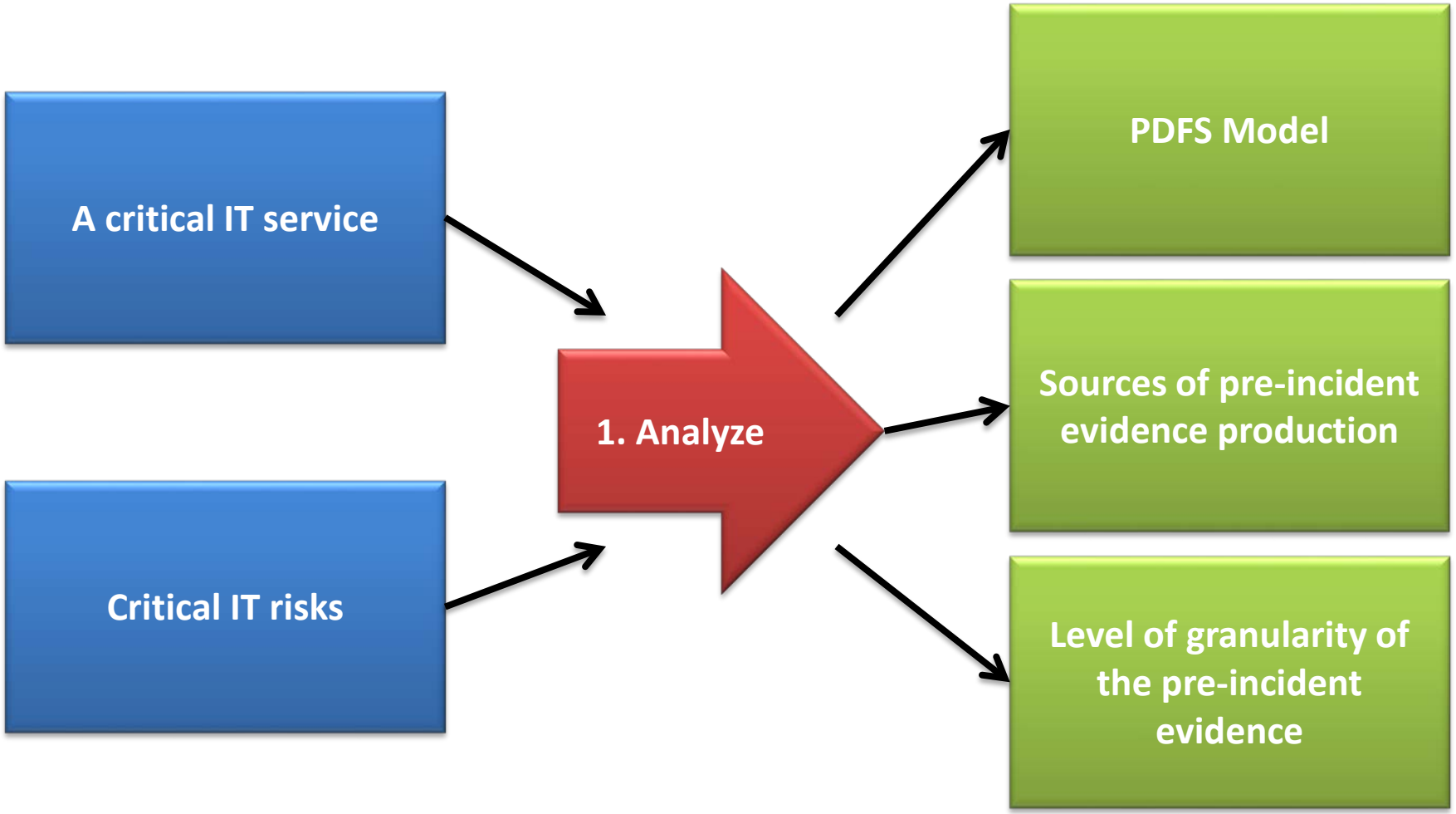
- A PDFS generally is a system whose elements are Agents that are implanted in technological components of the critical IT service.
- The Agents are responsible for collecting and sending the pre-incident evidence to one or more Remote Forensic Repositories which preserve and initialize the chain of custody.
- Additionally, PDFS can be incorporated into best practices related to Incident Response and traditional Computer Forensics.


Preventive Digital Forensics
Analyze
Calibrate
Build
In this context, PDFS generates specific pre-incident evidence that serve as input to traditional Digital Forensics.
Traditional Digital Forensics (NIST 800-86)
Collecting and Preserving Pre-Incident Evidence
Examination
Analysis
Reporting
Preparation
Detection & Analysis
Containment, Erradication & Recovery
Post-Incident Activity
Incident Response (NIST 800-61)

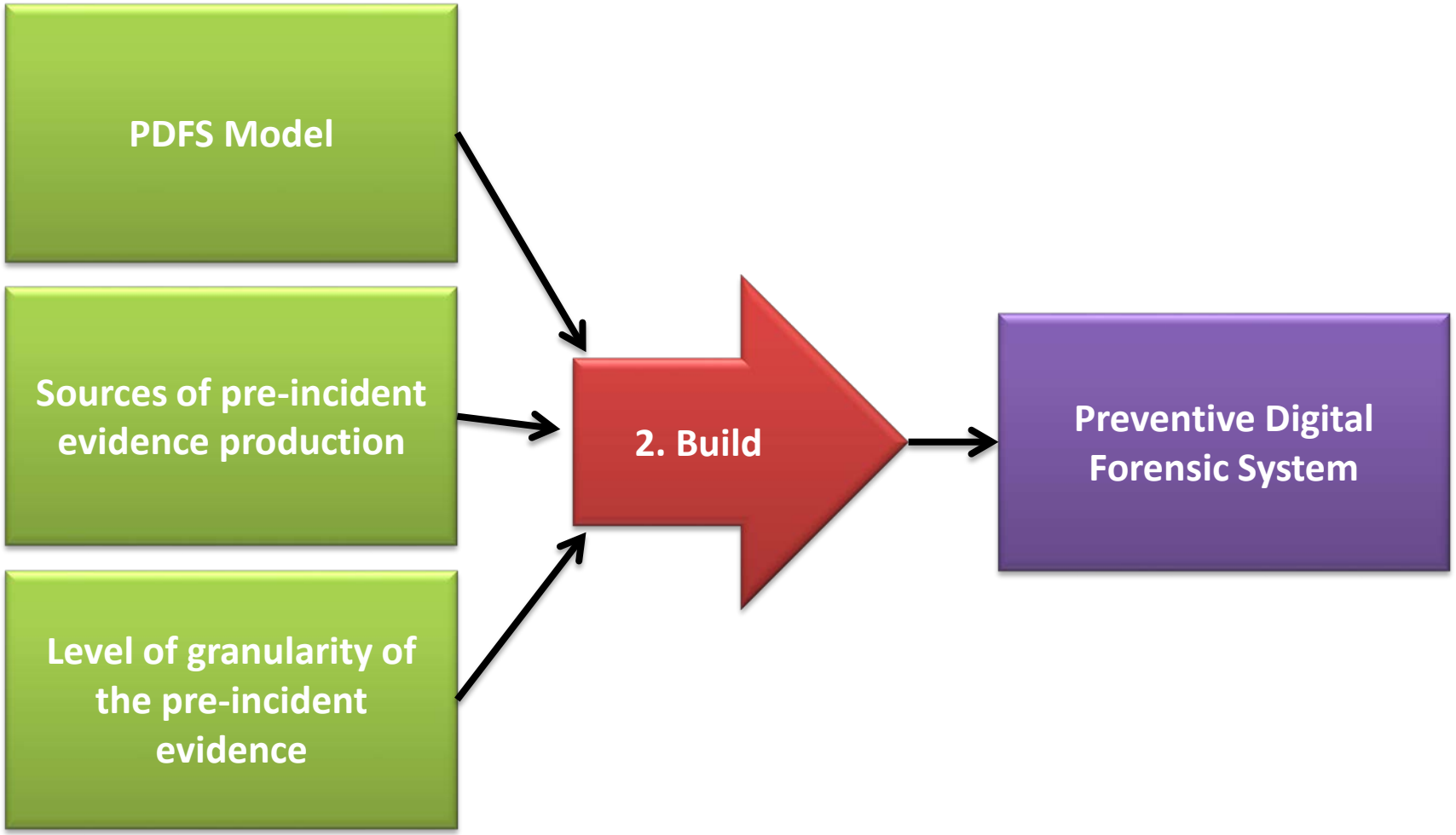
Preventive Digital Forensics Phases



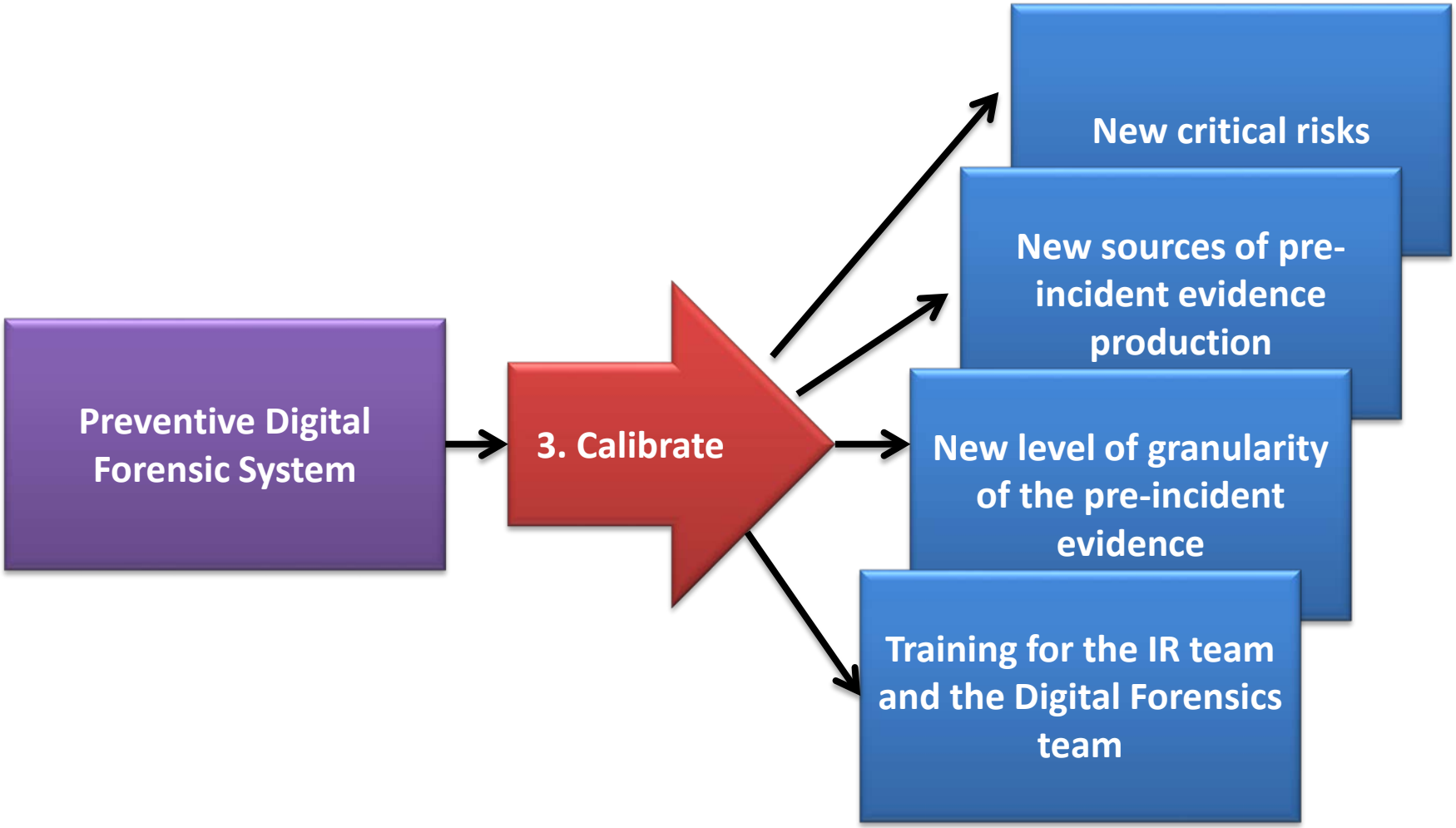
Preventive Digital Forensics methodology (1/3)



Preventive Digital Forensics methodology (2/3)



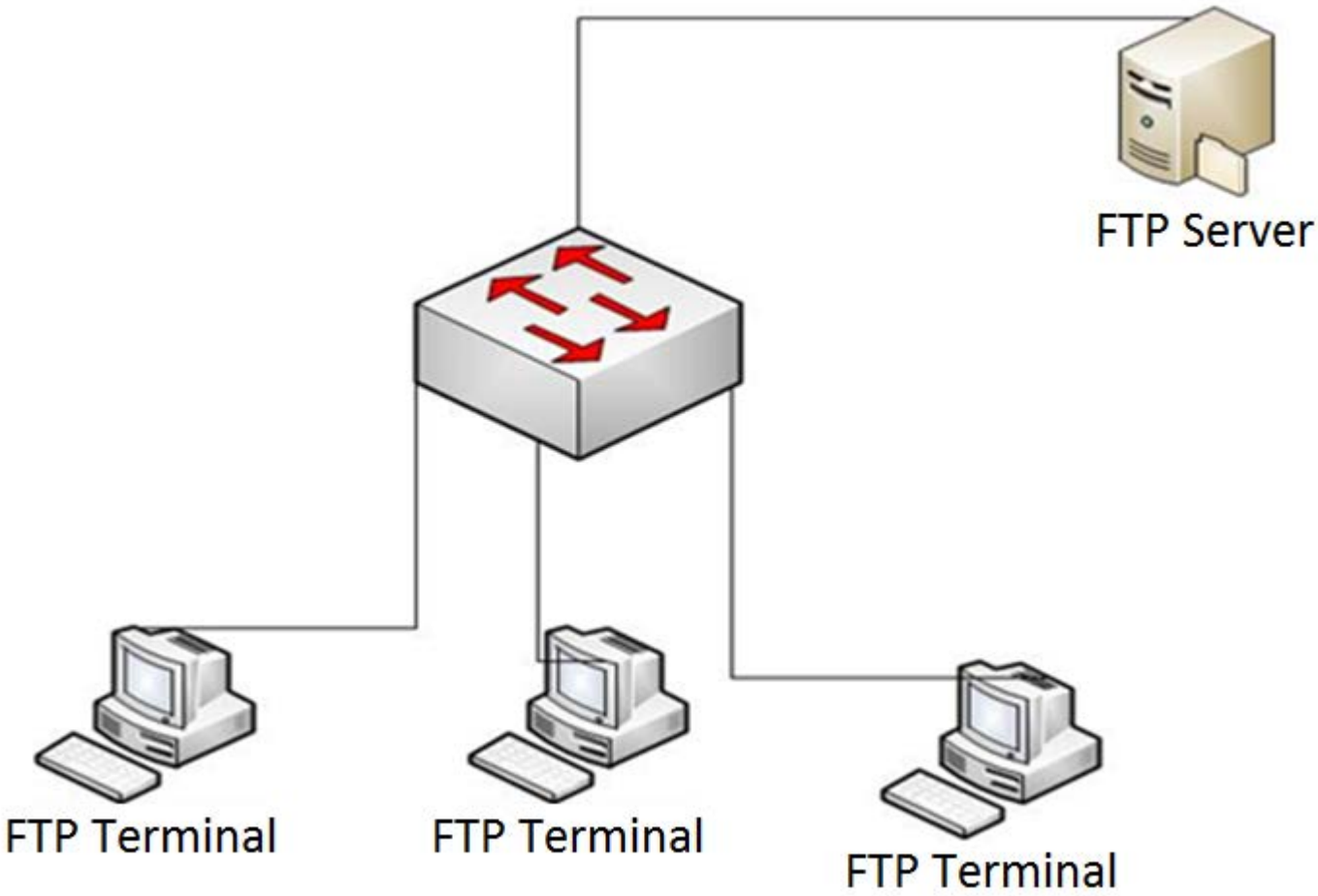
Preventive Digital Forensics methodology (3/3)



Case Study

- A company that we will name “Company X" is dedicated to designing advertising campaigns; has a critical IT service for collaboration and file sharing implemented on an FTP server that stores the final designs of the advertising campaigns for clients of the firm in question.
- If critical IT service is successfully attacked, Senior Management will want to have detailed and timely incident information to make the right decisions.

1. Analyze (Key input): Critical IT Service

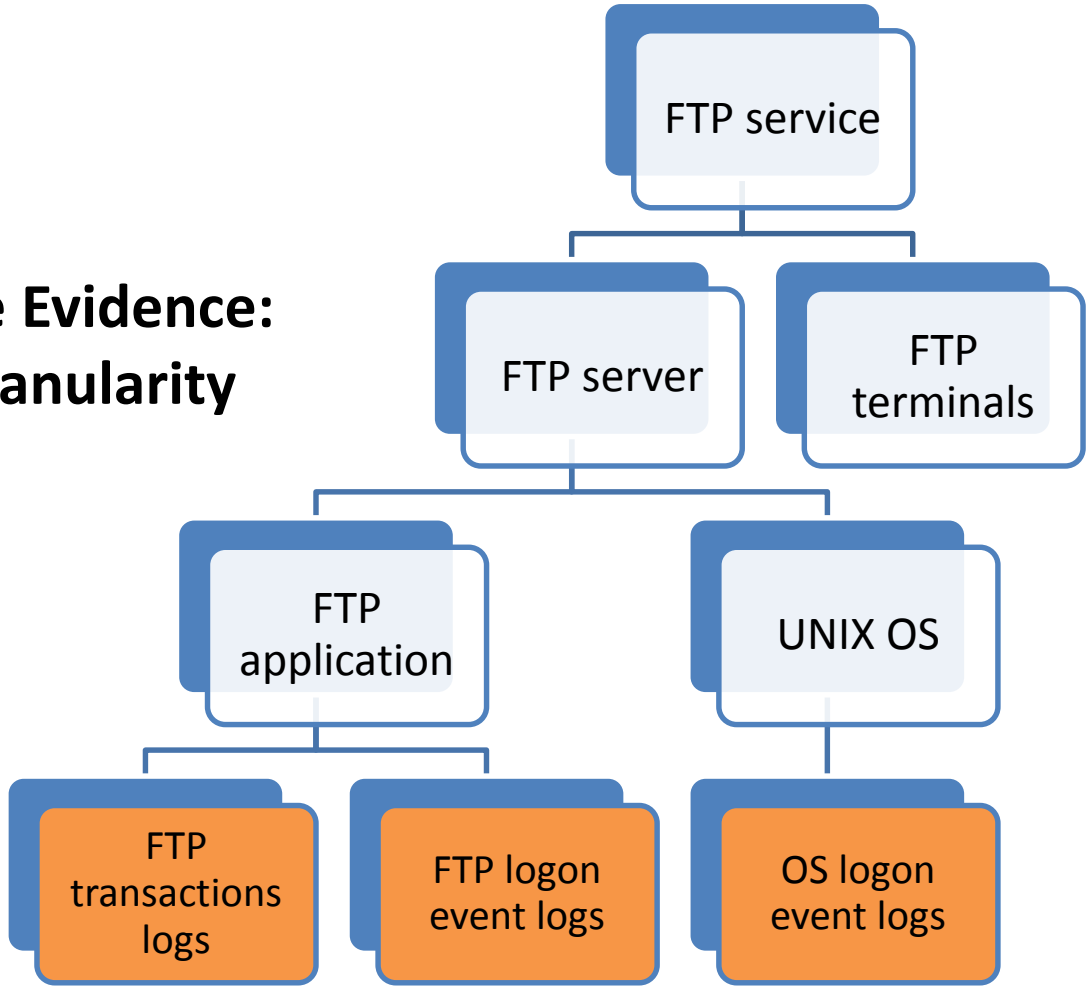


1. Analyze (key input): Critical IT risks

Threat	Risk estimated
Information leakage	High
Information theft	High
Intrusion on FTP server and FTP terminals	High

1. Analyze (key activity): Decomposition

Pre-incidente Evidence: Levels of Granularity



Source of pre-inicident evidence production

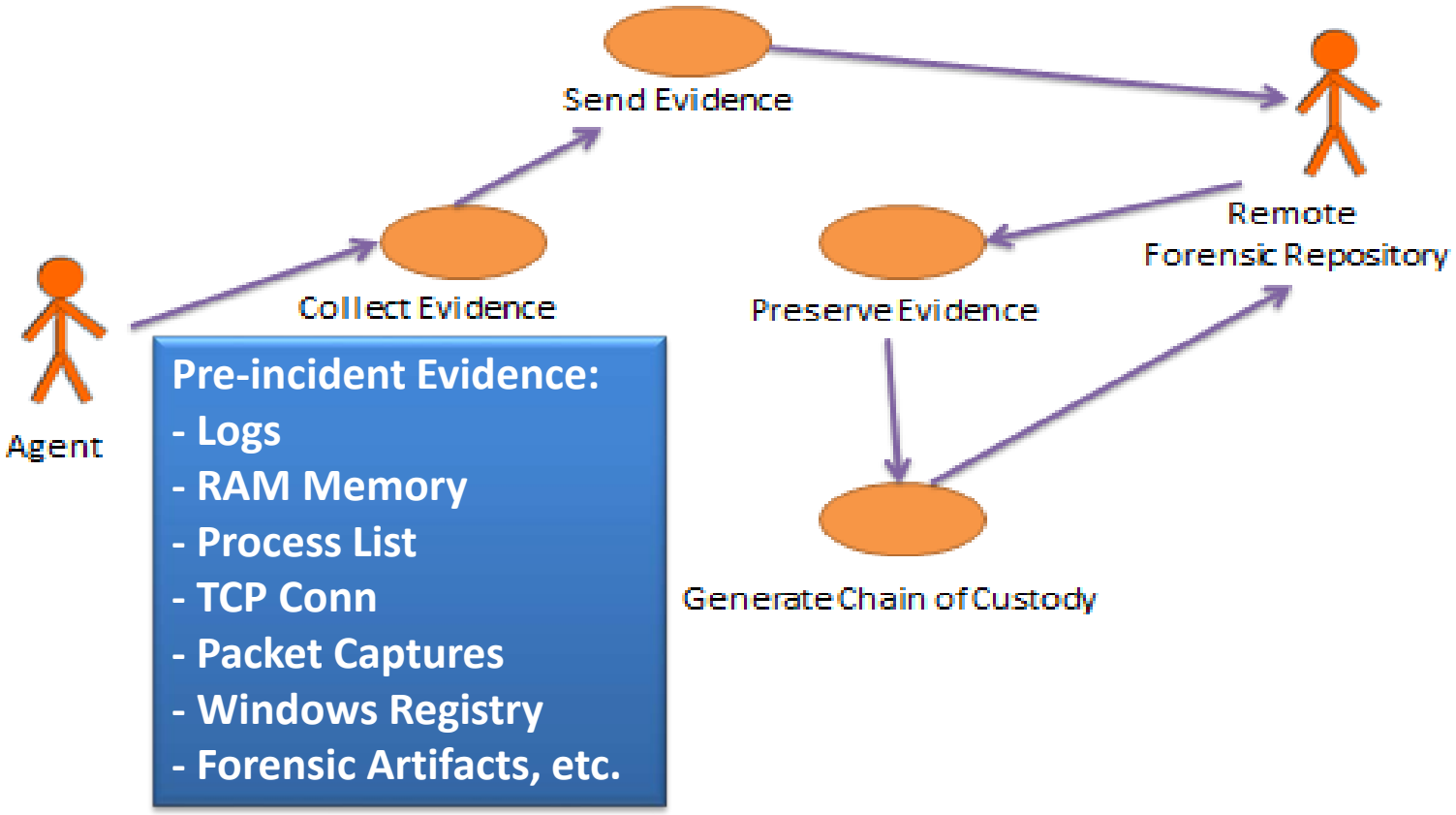
Critical IT Risks

(key output): Sources of pre… roduction and their level of g… larity

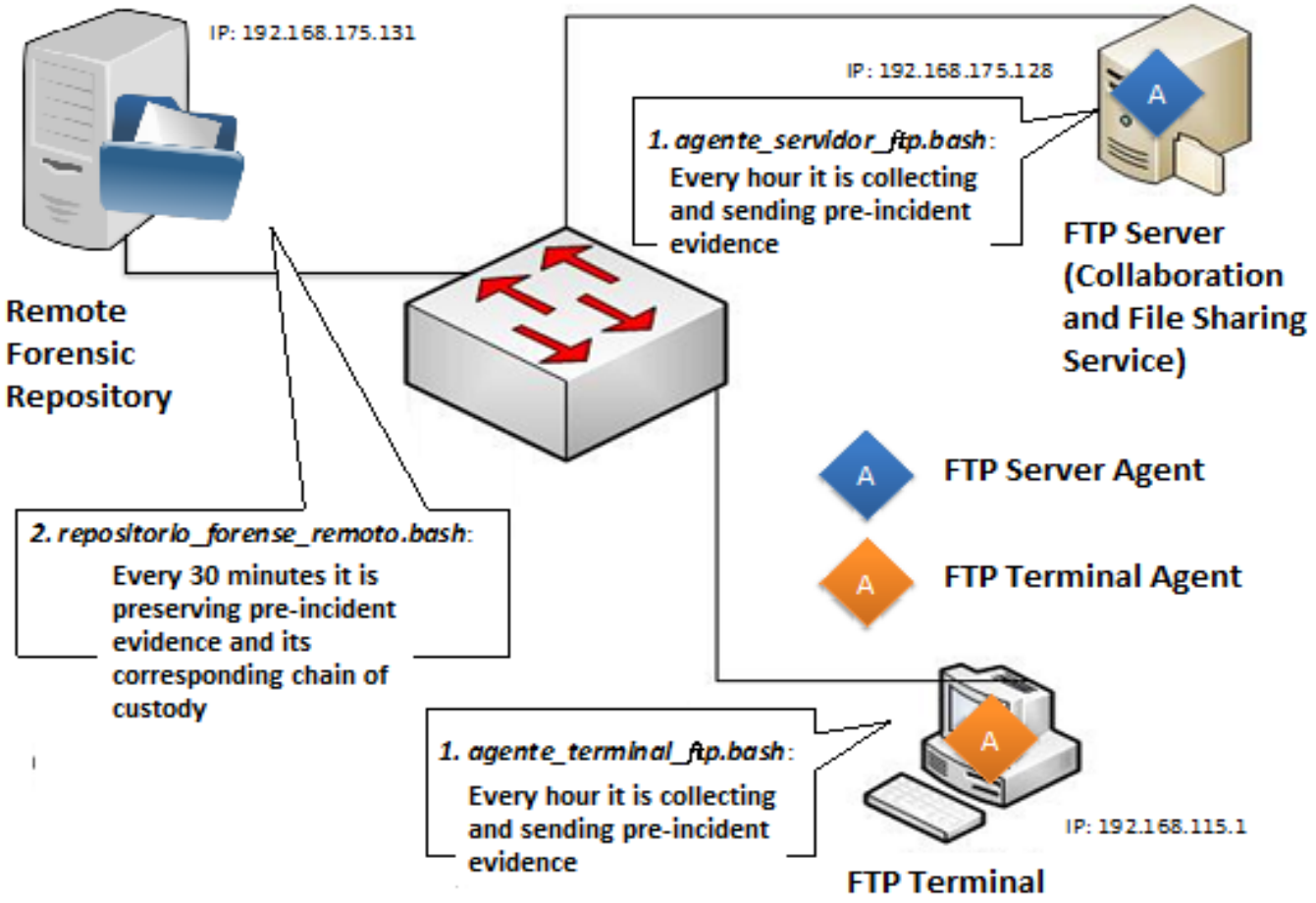
	Information leakage	Information theft	Intrusion on FTP server or FTP terminals
RAM memory (FTP server)	Process list and TCP connections		
RAM memory (FTP terminals)	Process list and TCP connections		
Syslog logs (FTP server)	OS logon events		
FTP logs	FTP transactions y FTP logon events		FTP logon events
Syslog logs (FTP terminals)	Not required		OS logon events and program execution list

Level of granulaty of pre-incident evidence

1. Analyze (key output): PDFS model



2. Build (Key output): The Preventive Digital Forensic System (PDFS)



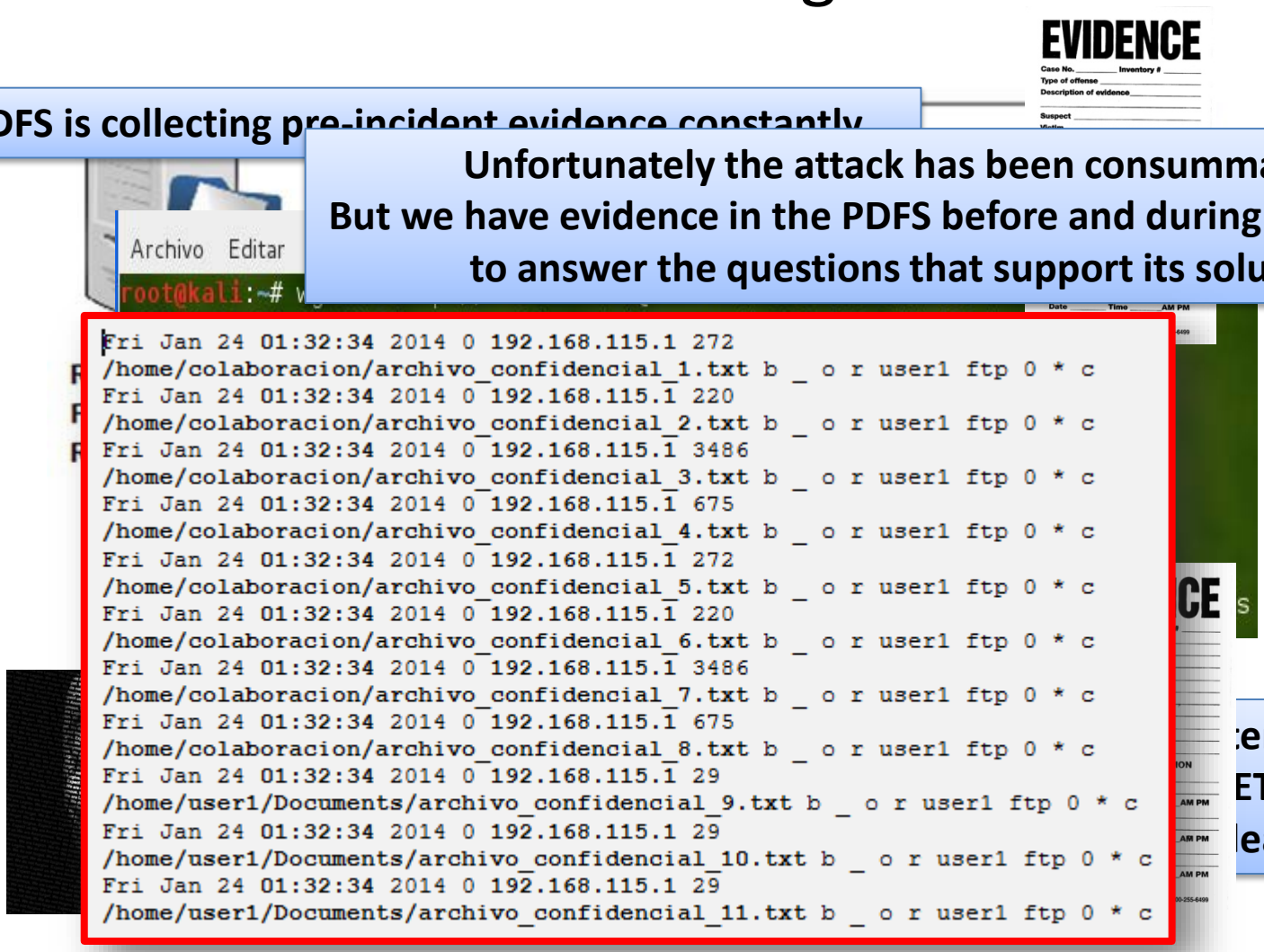
2. Build (Key output): The Preventive Digital Forensic System (PDFS)

- How can I build PDFS?
  - Open Source Solutions (log management tools, packet capture tools, computer forensics tools, etc.) + SW Development “in house” (C, C++, Java, Perl, Python, BASH, etc.)
  - Comercial Solutions (EnCase, AccessData, etc).

3. Calibrate: through PenTest

The PDFS is collecting pre-incident evidence constantly

Unfortunately the attack has been consummated.
But we have evidence in the PDFS before and during the incident to answer the questions that support its solution.



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Conclusions

- *"… If ignorant both of your enemy and yourself, you are certain in every battle to be in peril."* – Sun Tzu, The Art of War.
- If it is known which are the critical organizational systems and their information security risks then, configure these systems in such a manner that they facilitate computer forensics, in order to:
  - discover and evaluate indicators of malicious behavior,
  - and to give an effective response to computer security incidents.
- The pre-incident evidence is a reliable source to detect and to mitigate threats.

Refs

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  - http://www.kshimss.org/smart05-bin/public/downloadlibrary?&itemid=8715224764327446623 5

Thanks!

Questions & Anwers

jesus.ramirez.pichardo@gmail.com
Twitter: @jesusrpichardo