# Forensic Analysis of Web Data

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# Introduction

- using collected data in surveys
- influence to known investigative models
- appropriate investigation model
- digital preservation
- legal issues
- deep web crawling
- format of data
- designing a deep web crawler

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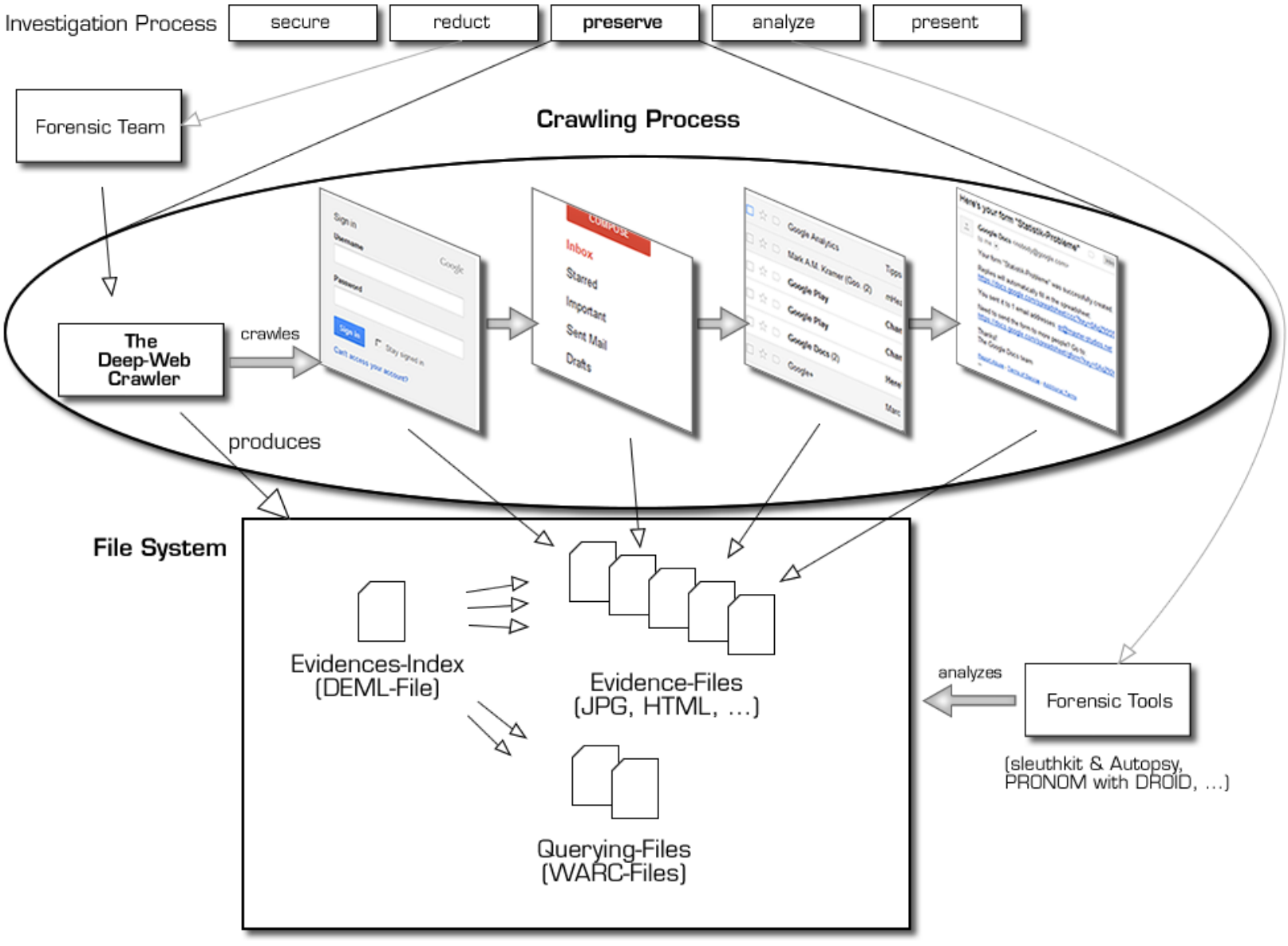
# The Investigation S(RP)AP

- secure
- **reduct**
- **preserve**
- analyze
- present

Best for online crime investigation!

# The Process


Investigation Process
secure
reduct
preserve
analyze
present
Forensic Team
Crawling Process
The Deep-Web Crawler
crawles
produces
File System
Evidences-Index (DEML-File)
Evidence-Files (JPG, HTML, ...)
Querying-Files (WARC-Files)
analyzes
Forensic Tools
(sleuthkit & Autopsy, PRONOM with DROID, ...)

# The Process (2)

- Where was the evidence stored?
- Who had obtained the evidence?
- What has been done to the evidence?

# "reduct"

- reduce amount of data to crawl (also time)
- crawling websites: XPath
- simulate user navigation and interaction
- defined by investigation team
- be aware: unimportant data maybe later important

# ”preserve”

- preservation of evidences up to 60 years (StPO §60)
- important due to file formats (determined with DROID)
- for web crawling WARC file format (open format)
- for immediate investigation: normale files
- the index: DEML file
  - by National Centre for Forensic Science
  - Digital Evidence Markup Language
  - compatible with Global Justice XML Data Model (GJXDM)
  - File (inheritance: DigitalArtefact, Allocated) important for online investigations

# "analyze"

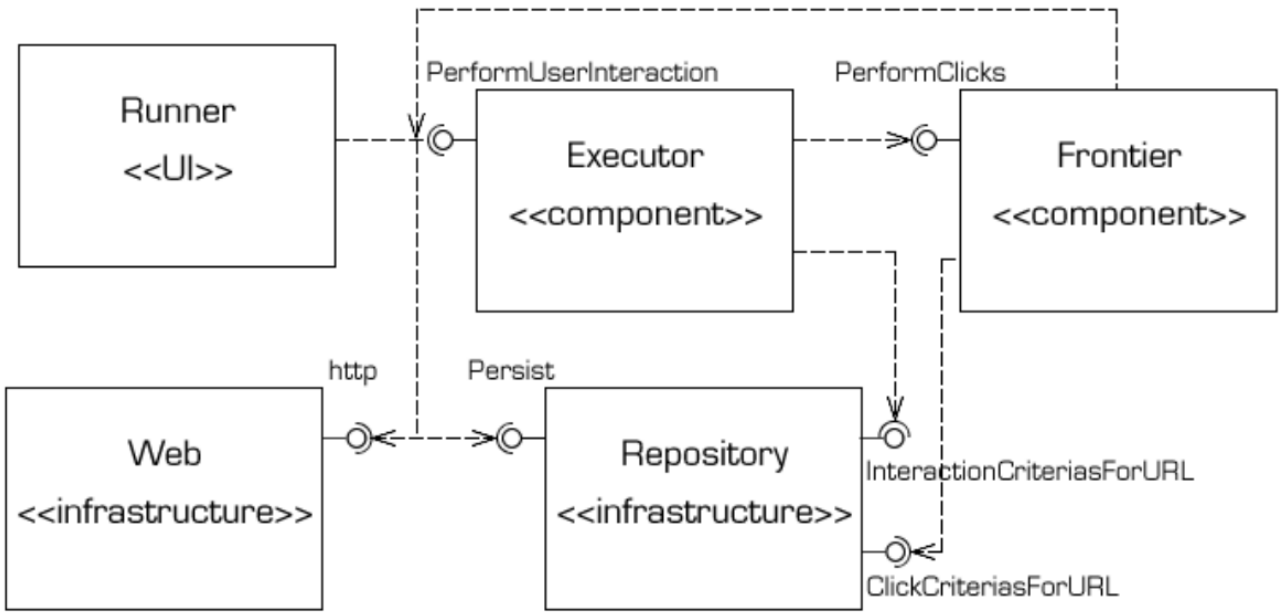
- file analysis: sleuthkit, Autopsy, PRONOM (with DROID)
- own tools and usage of graph-expression (Google)
- timeline and correlation reconstruction:
  - model from the National Centre for Forensic Science
  - Application, Content, Principal, System

# The Deep Web Crawler

Challenges:

- the use of AJAX technology in web pages
- the simulation of user interaction with HTML elements (e.g. forms)
- the use of Captchas in web pages

# The Architecture



# Simple Example

```
<?xml version="1.0"?>
<cratalis start-url="http://kurier.at"
    name="Kurier Crawling"
    start-action-sequence="1">
  <action-sequence id="1">
    <action type="StartAction" id="1"
        comment="start every link" save="true"
        action-sequence-id="3">
          .//a[@href and
          not(starts-with(@href, "#"))]
    </action>
  </action-sequence>
  <action-sequence id="3">
    <action type="SaveAction" id="3"
        comment="just save" save="true"/>
  </action-sequence>
</cratalis>
```

# More complex example

```
<?xml version="1.0"?>
<cratalis start-url="http://www.studivz.de" name="StudiVZ" start-action-sequence="1"
      deml-file="studivz/studivz.xml">
  <action-sequence id="1">
    <action type="JavaScript" id="1" comment="filling out the login form"
          save="true" save-file="studivz/login-screen.html">
        var usernameInputs = document.evaluate(".//*[@id='Login_email']", ...);
        var usernameTextBox = usernameInputs.iterateNext();
        usernameTextBox.value = "forensicanalysis@ymail.com";
        var passwordInputs = document.evaluate(".//*[@id='Login_password']", ...);
        var passwordTextBox = passwordInputs.iterateNext();
        passwordTextBox.value = "gustav";
    </action>
    <action type="StartAction" id="2" save-file="studivz/home.html"....></action>
  </action-sequence>
  <action-sequence id="2">
    <action type="StartAction" id="3" save-file="studivz/inbox.html"></action>
  </action-sequence>
  <action-sequence id="3">
    <action type="JavaScript" id="4" comment="start other action to overview" ...>
        var msgLinkList = document.evaluate(
              ".//div[contains(@class,'from-subject')]/.../a", ...);
        var msgLink;
        var count = 0;
        while(msgLink = msgLinkList.iterateNext()) {
            count++;
            msgLink.onclick.apply(msgLink);
            savePage('studivz/msg' + count + '.html');
        }
    </action>
  </action-sequence>
</cratalis>
```

# Usage

- investigative
  - collecting bitcoin addresses (clear and dark net)
  - saving evidence files from the web (also via Tor)
- non-investigative
  - collecting event data
  - ... person data (incl. relations)
  - ... news
  - ... locations
  - ... bitcoin addresses and names
  - many others still done