Is Digital Forensics a Science ?

The 1st International Conference on Digital Forensics and Investigation

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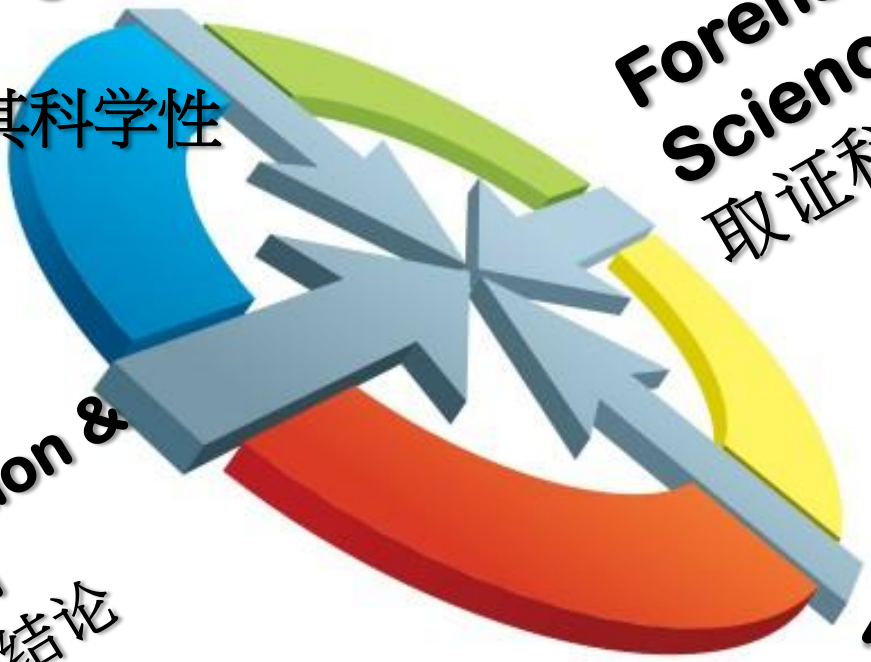
Is Digital Forensic a Science

How Scientific is Today's Digital Forensic
数字取证其科学性



Forensic Science
取证科学

Digital Forensic
数字取证

Event Reconstruction & Conclusion
事件重构&结论

Forensic science is science used for the purpose of the law

Crime Scene to Court – The Essentials of Forensic Science,
Peter White

取证科学是用于法律目的的科学

What is "Science"

Science is collection of systematic methodologies used to increasingly understand the world

Forensic Science: Modern Methods of Solving Crime,
Max M. Houck

科学是帮助理解世界的系统的方法

Forensic Science is a Historical Science

- Events (crimes) have occurred in the past (犯罪)事件是已发生的
- You did not witness the crime as it occurs 事件发生时，您并没有目击到
- Identify and analyze the traces left behind 识别并分析留下的踪迹
- Interpret the actions of perpetrator & victim, formulate forensic conclusion 解析罪犯&受害者的行为，陈述取证结论

Where the "Trace" come from

Locard's Exchange Principle

Every contact leaves a trace; when 2 things come into contact, information exchange

每一次联系都会留下踪迹；当两个事物发生关联时，必然有信息的交换。

The traces reveal associations between people, places and things

踪迹揭示了人物、地点、事件之间的相关性

These associations can only be obtained by interpretation of traces

这些相关性只能通过"解析"踪迹而获得

Interpretation & Scientific Method

It is the *interpretation* of the data collected through the *scientific method* that leads to knowledge.
Mere collection of data means nothing
引导认知的是通过科学方法对收集的数据进行的解析。
仅仅收集数据是没有用的。

Bloodstain Pattern Analysis
T. Bevel & R. Gardner

- **Mere guess or personal opinion is not interpretation** 仅猜想或个人意见是无法解析
- **Interpretation is a mixture of inductive and deductive inferences through the use of scientific method**
  解析是归纳&推断理论科学方法的相结合。

Deductive and Inductive Inferences

Deductive inference is that the conclusion must be true if the premise is true

推论：若前提是真实的，其结论必然是真实的

Inductive inference is that the conclusion is likely to be true if the premise is true

归纳：若前提是真实的，其结论有可能是真实的

Deductive and Inductive Inferences

If "Crime A" is true, then "Trace B" is true (i.e. "Crime A" is causal event to "Trace B")
如果罪行A是真，那么踪迹B是真（即罪行A是踪迹B的诱因）

Deductive Inference

A is true

Therefore *B* is true (conclusion)

B is false

Therefore *A* is false (conclusion)

Inductive Inference

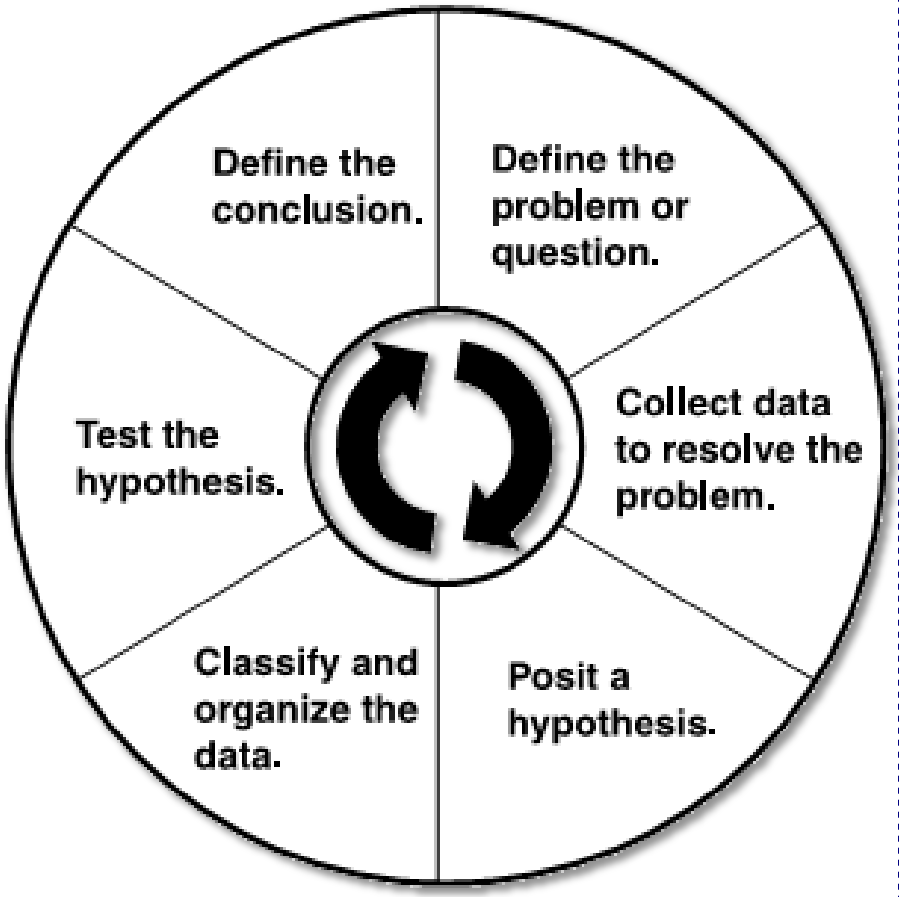
B is true

Therefore *A* becomes plausible (conclusion)

A is false

Therefore *B* becomes less plausible (conclusion)

Scientific Method



- Identify the problem to be resolved

  确定待解决的问题
- Collect & gather data that may establish an answer to the question

  收集可能与答案有关的数据
- Posit hypothesis regarding the problem

  设立该问题的假设
- Classify & organize the collected data for interpretation

  分类整理收集的数据以作解析
- Test the hypothesis by comparing expectations for a given hypothesis against the observed data

  通过对比预期结果和观察数据来测试假设
- Draw a conclusion from the information examined

  通过调查的信息得出结论

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What is "Digital Forensic"

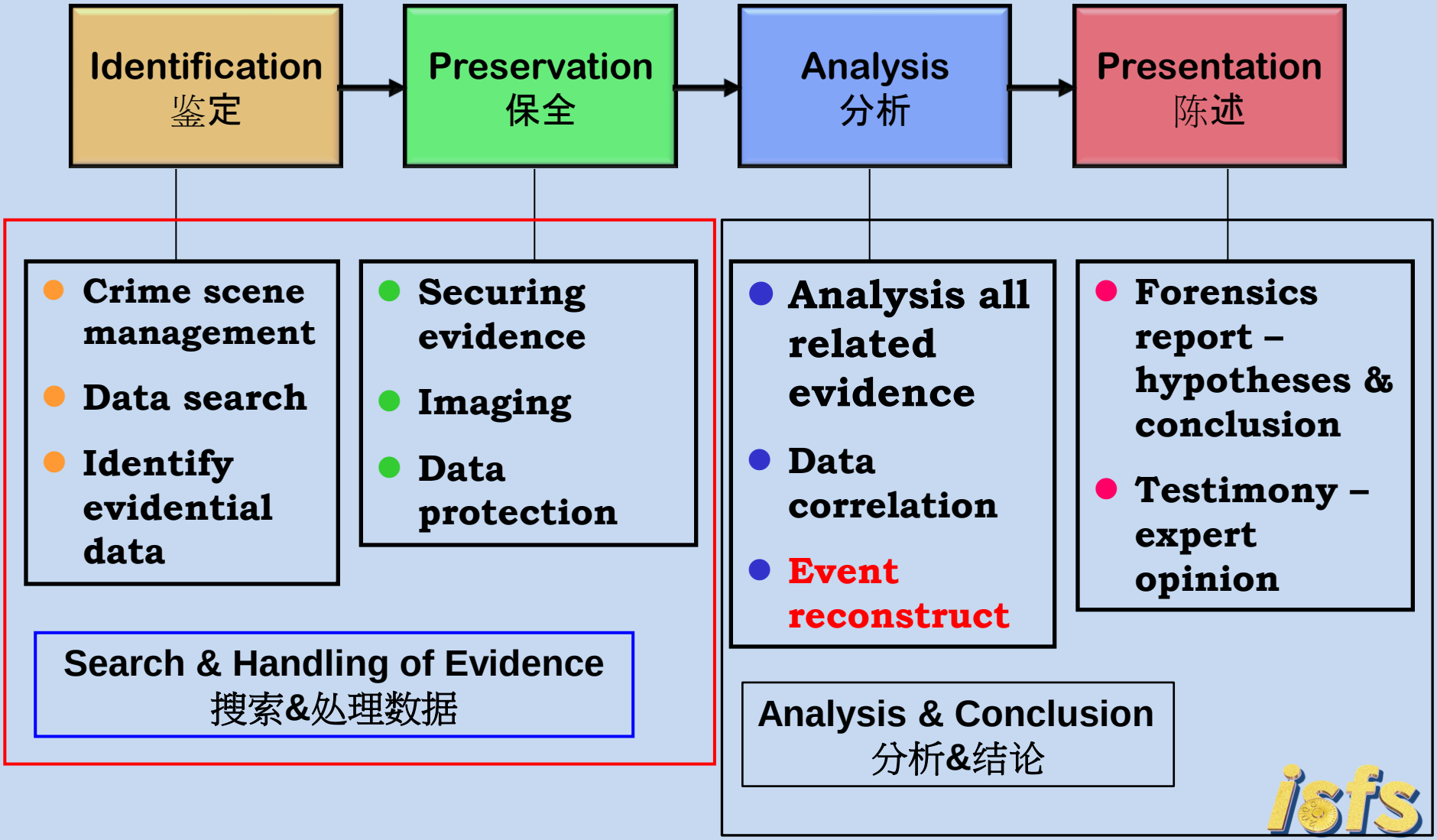
- **No difference to traditional forensic science – A historical science**
  与传统取证科学无差异
- **Identify and analyze the digital traces left behind**
  识别并分析留下的电子踪迹
- **Interpret the actions of perpetrator & victim, formulate forensic conclusion**
  解析罪犯&受害者的行为，陈述取证结论

Locard's Exchange Principle & Digital Traces

Locard's Exchange Principle also applies to Digital Traces

Computer Generated Record 电脑生成记录
Shows computer processes that have been performed, e.g. system logs
体现计算机运行记录，如：系统日志
Computer Stored Record 电脑存储记录
Shows user's actions performed on created files e.g. date & time stamps
体现创建文件时的用户行为，如：时间戳

The Processes of Digital Forensics



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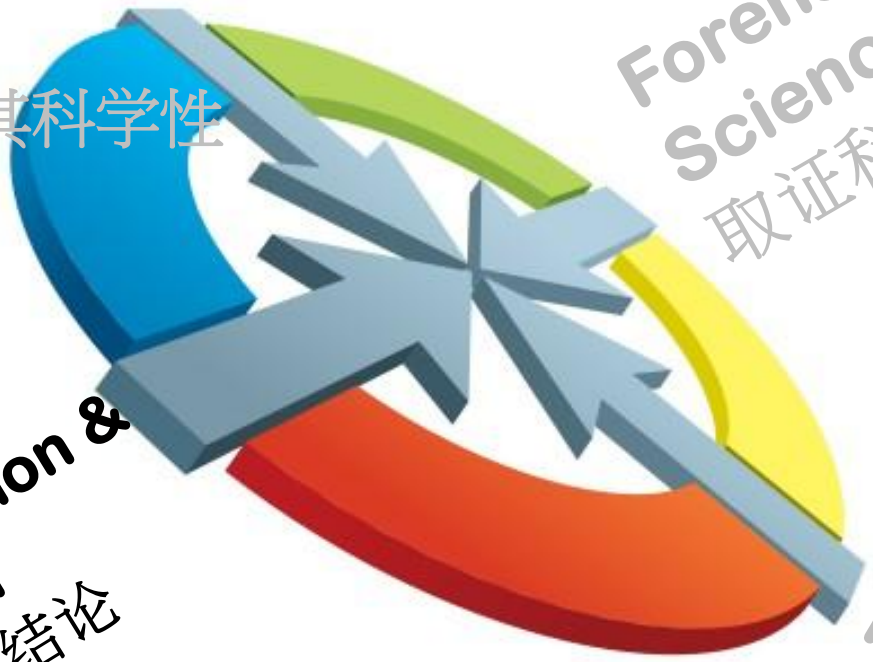

Forensic Science
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Event Reconstruction & Conclusion
事件重构&结论

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Event Reconstruction Processes

- The crime is indeed an incident 犯罪是一种事故
- An incident is made up of events 某一事故由多个事件构成
- An event is comprising of specific actions, which turn out to be the traces or evidence 某一事件由多个特殊行为构成，行为体现为踪迹或证据

Event reconstruction is "walk-back" processes

事件重构是"回溯"这些过程

Traces → Event

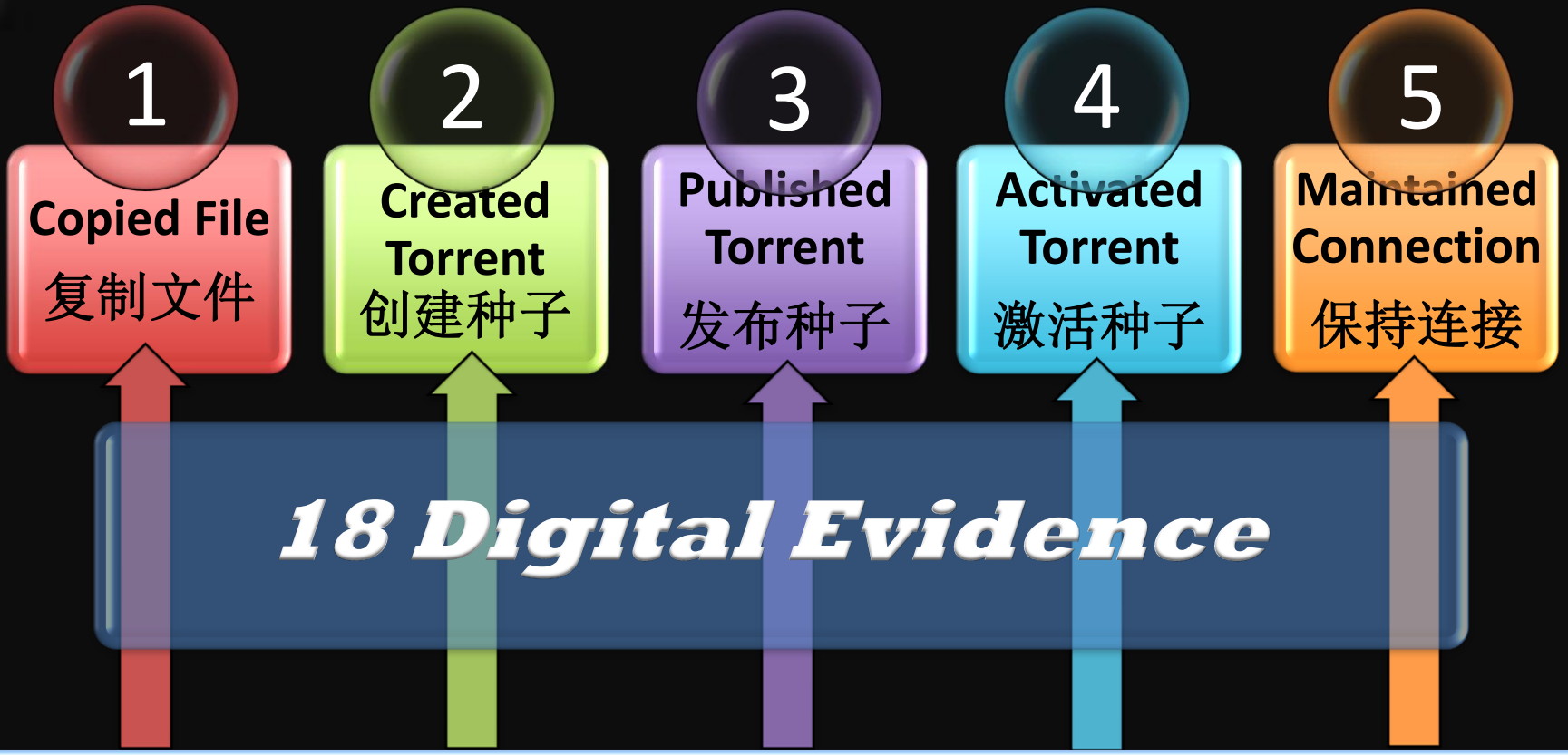
Reconstructed Event → Incident (Crime)

How to Achieve Event Reconstruction

- Identify incident and related events 鉴定事故及相关事件
- Identify traces that are caused by the e
  鉴定事件所引发的踪迹

- Collect data and establish the likely events that could have caused the data 收集数据并构建引发这些数据的可能性事件
- Consider these events in relationship to one another to establish the order of sequence 综合考虑事件相关性，并建立其发生的顺序
- If contradictory sequence existed, au
  determine which is more probable
  序，需评审证据并判断哪一个的可能性更
- Flow chart the overall incident based on the events and their determined sequence 基于事件及确定的顺序，规划出整个事故的流程图

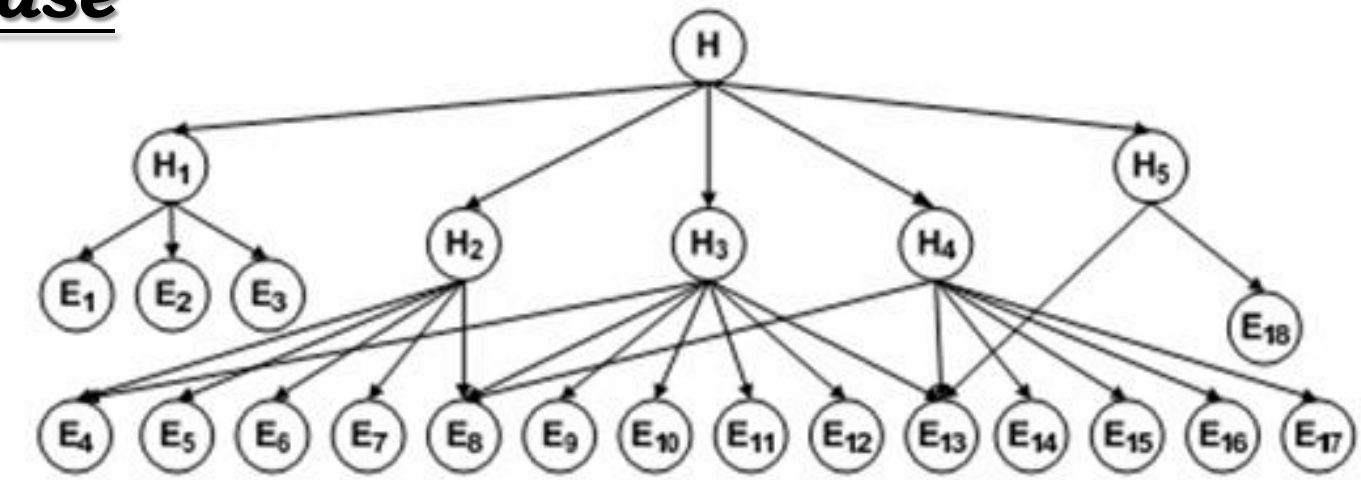
Case Example – BitTorrent File Sharing



The seized computer was the *1st seeder* distributing the pirated movie via BT network

获取的计算机是第一个通过**BT**网络分发侵犯版权电影的***seeder***。

Event Reconstruction Processes of the BT Case



HYPOTHESES:

H The seized computer was used as the initial seeder to share the pirated file on a BitTorrent network

H_1 The pirated file was copied from the seized optical disk to the seized computer

H_2 A torrent file was created from the copied file

H_3 The torrent file was sent to newsgroups for publishing

H_4 The torrent file was activated, which caused the seized computer to connect to the tracker server

H_5 The connection between the seized computer and the tracker was maintained

Event Reconstruction Processes of the BT Case

EVIDENCE:

- E_1 Modification time of the destination file equals that of the source file
- E_2 Creation time of the destination file is after its own modification time
- E_3 Hash value of the destination file matches that of the source file
- E_4 BitTorrent client software is installed on the seized computer
- E_5 File link for the shared file is created
- E_6 Shared file exists on the hard disk
- E_7 Torrent file creation record is found
- E_8 Torrent file exists on the hard disk
- E_9 Peer connection information is found
- E_{10} Tracker server login record is found
- E_{11} Torrent file activation time is corroborated by its MAC time and link file
- E_{12} Internet history record about publishing website is found
- E_{13} Internet connection is available
- E_{14} Cookie of the publishing website is found
- E_{15} URL of the publishing website is stored in the web browser
- E_{16} Web browser software is available
- E_{17} Internet cache record about the publishing of the torrent file is found
- E_{18} Internet history record about the tracker server connection is found

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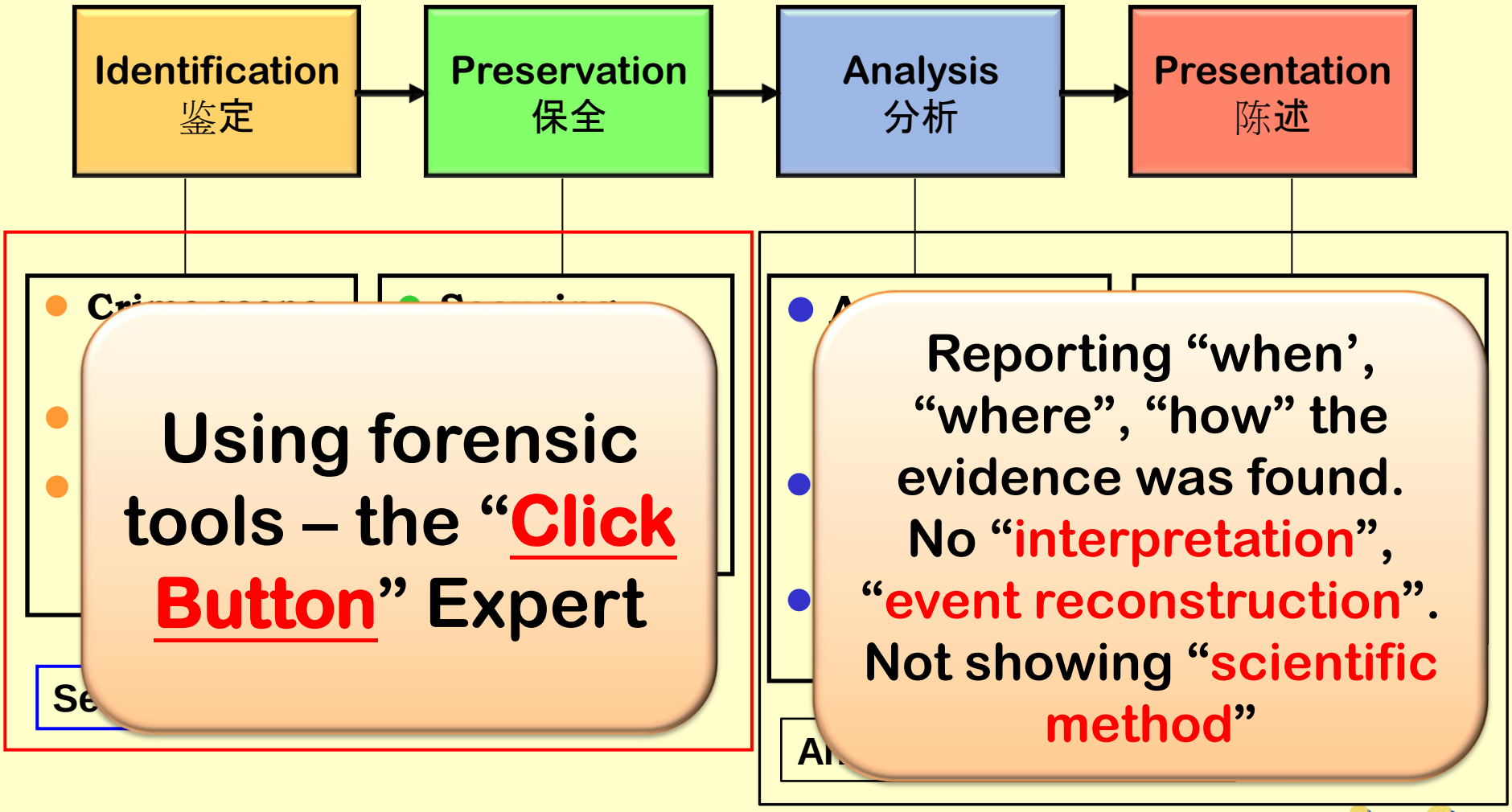
What Most Digital Forensic Examiners Doing Today



The Impact of "Click Button" Approach

- **Without any scientific interpretations, false-positive scenarios cannot be eliminated → easy to fabricate digital traces for the tools to find**
  缺乏科学的解析方法，就难以避免错误真→易伪造工具能找到的数字踪迹
- **"Is the examination performed by the expert or the software?" → the digital forensic expert is just a technician; reliability and credibility of the expert are impeded**
  "检查是由专家还是由软件完成的呢？"
  →数字取证专家只是一个技术员，难以保证专家的可靠性与可信性

It's time to be a Digital Forensic Scientist

- Digital forensic per se is scientific
- It is the digital forensic "expert" who is not doing his/her forensic job scientifically

STOP being a "CB" expert; be a digital forensic scientist !

IF WE FAIL TO ACT NOW, WHO WILL ?

Q and A