Attack Trees

Adversarial Behaviours

Attack Trees

Adversarial Behaviours

- Origin of attack trees is **debatable**, NSA involved in development, Schneier evangelised.
- Conceptual diagrams for **considering and discussing** threats to systems.
- **Common technique** used across multiple domains and not restricted to computing science.
- Attacks trees can be considered a **formal** approach of organising, discussing and finding threats to systems.

Attack Trees

Adversarial Behaviours

- Afford designers to **capture**, **communicate** and **consider** various attacks at high-level.
- Act as **documentation** for systems of the consideration of particular attacks.
- Can construct **numerous** attack trees for multiple perspectives.
- Can create **library** of attack trees that can be reused in various instances.

Attack Trees

Adversarial Behaviours

- May reveal what is the **crucial attacks** to consider, rather than what is perceived.
- Concern that attack trees are **incomplete**, they always likely only represent what is known.
- Attack trees are a useful starting point, but the should be cemented with **research**, **investigation** and **peer-review.**

Root

Attack Trees

- **Ambiguity** about the root of an attack tree, can differ between approaches and assumptions by creators.
- Generally the root of an attack would be the **goal of the adversary** or high-impact action.
- **Motivation** for understanding the root influences the branches.

Root

Attack Trees

- **Adversary goal** we want to consider all the paths that are necessary to achieve the goal.
- **High-impact action**, then we should consider what would happen to cause the action to happen.
- These are the two perspectives restrict consideration around.
- Multiple perspectives and approaches can be adopted.

Goal

Attack Trees

Goal

Attack Trees

Attack Nodes

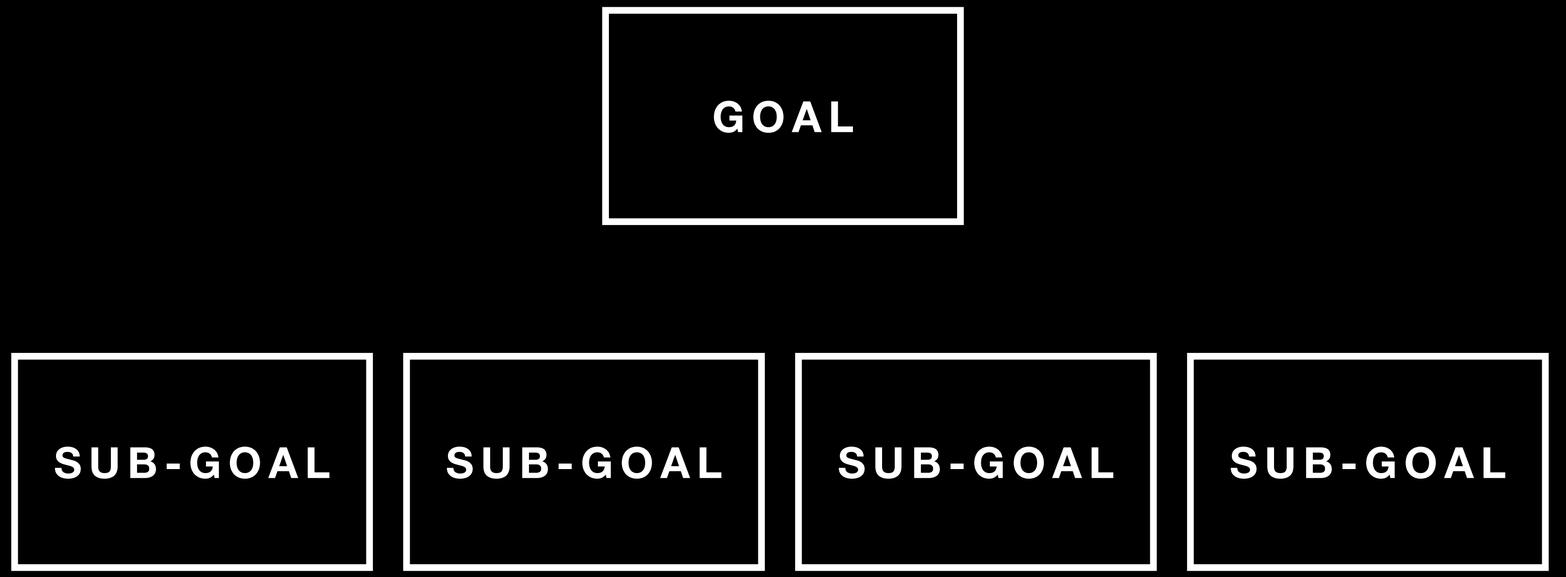
Attack Trees

- Common trees, may have similar **patterns** or predictable structure.
- Attacking system the first set of attack notes may be **physical access**, **compromise software** or **person**.
- **Attacking** a system via a people, process or technology.
- Attack system **during** its system, design, implementation, production etc.

Goal

Attack Trees

Sub-goal
Attack Trees



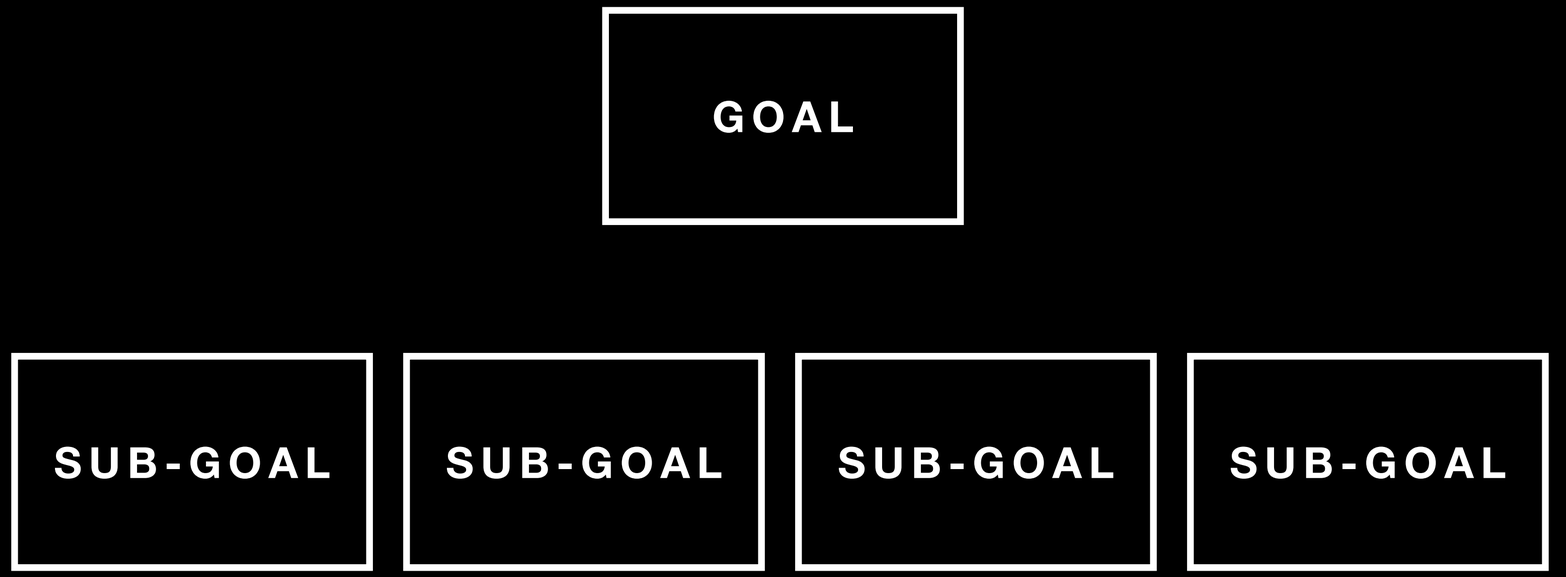
Sub-goal
Attack Trees

Sub-goal
Attack Trees

- Can consider each attack node in turn as **sub-goals** of the adversary.
- Each attack node can likely be **decomposed** into further sub-goals and so on and so forth.
- Each layer of sub-goals and can be considered another level when considering the attack.

Sub-goal
Attack Trees

Sub-goal
Attack Trees



Achieving Goal

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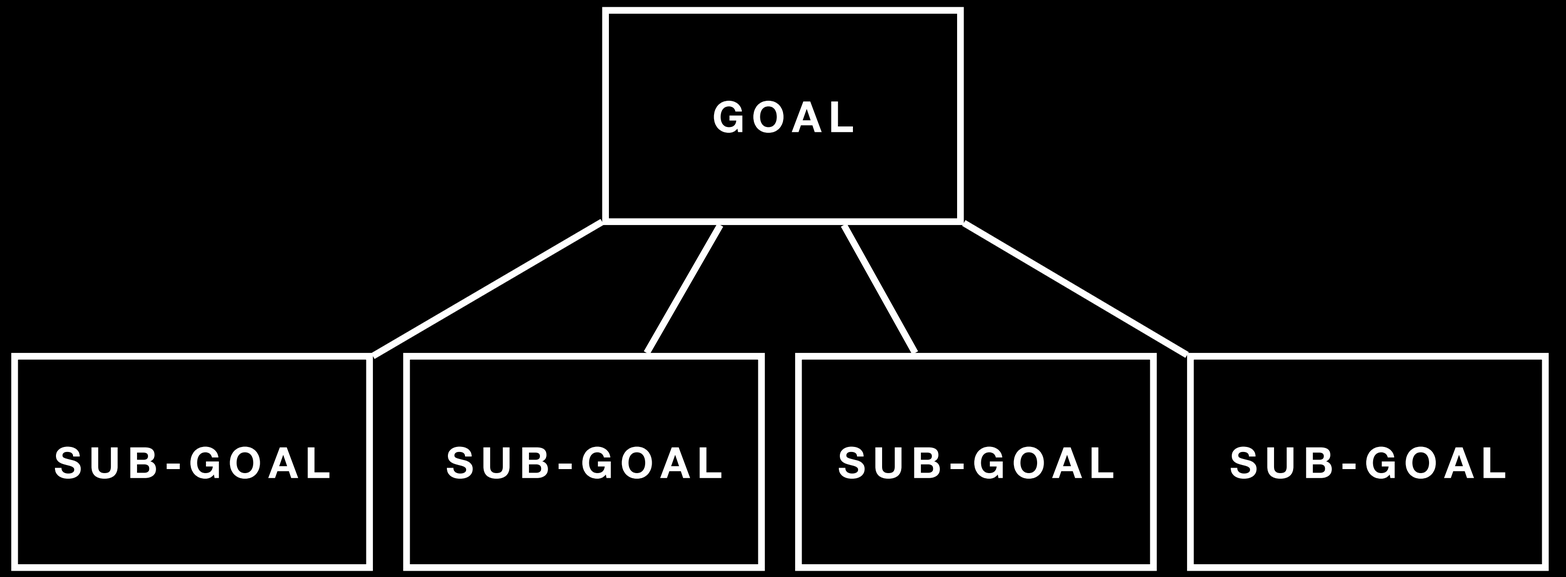

Achieving Goal

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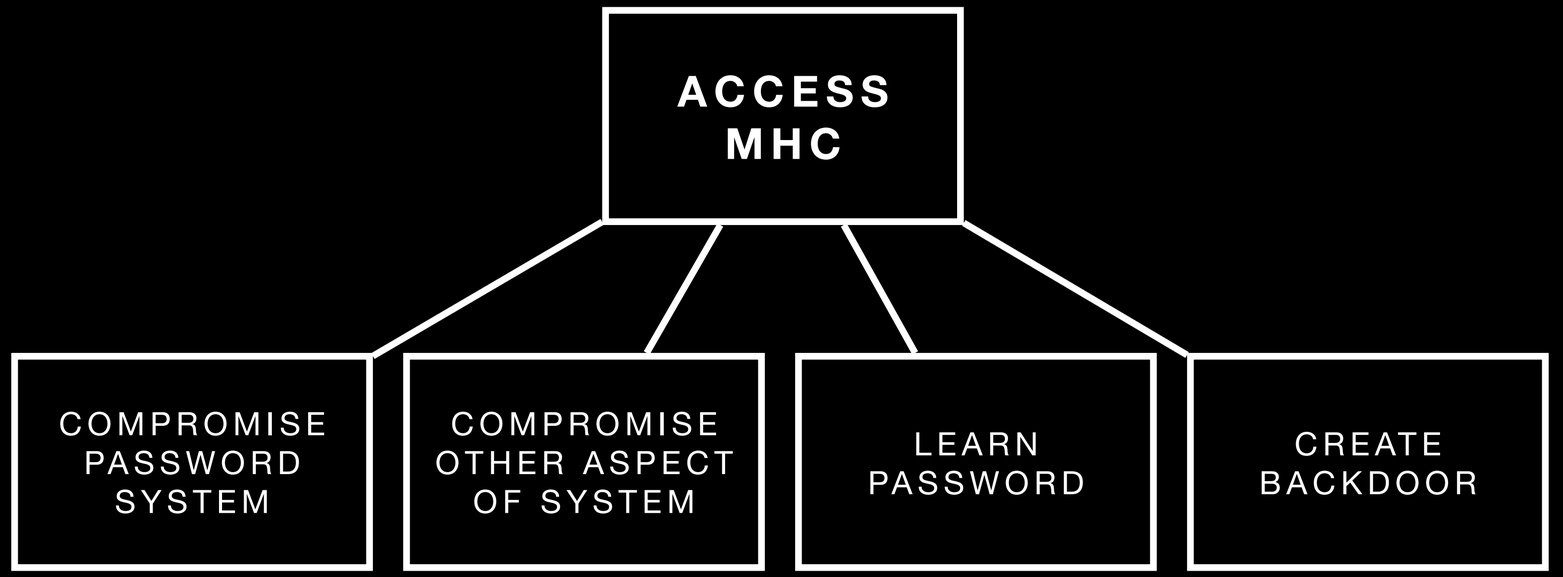

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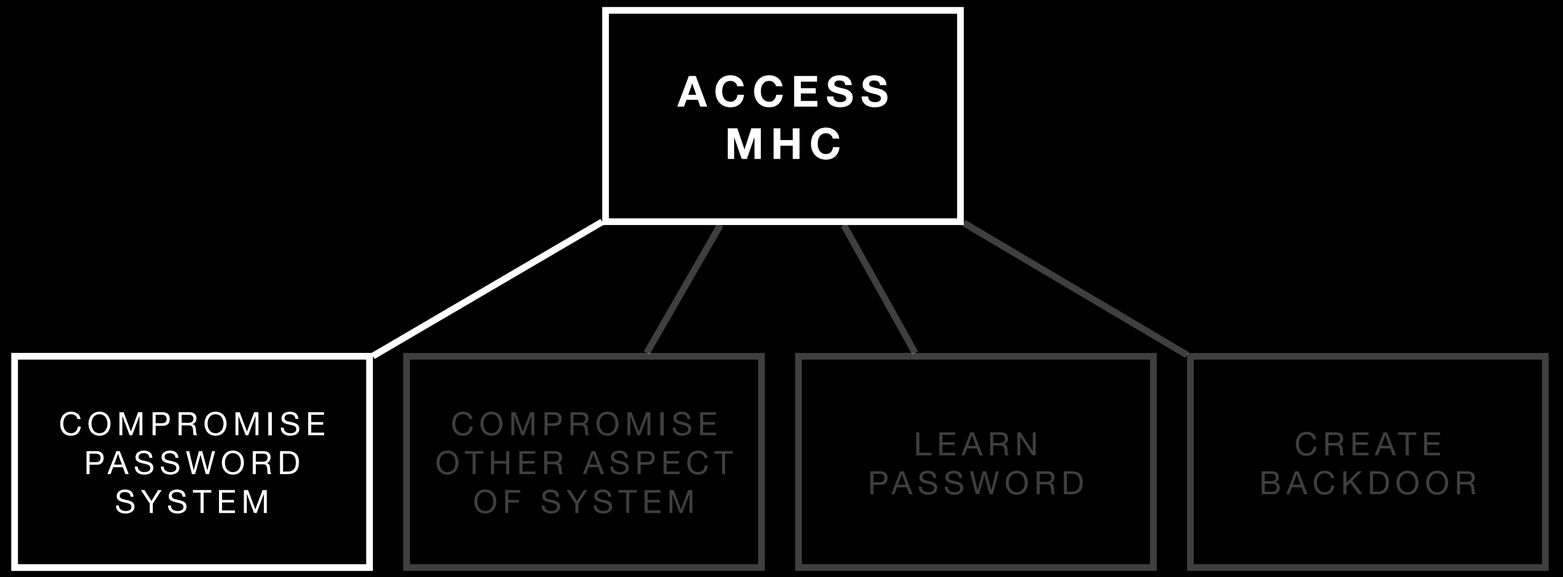

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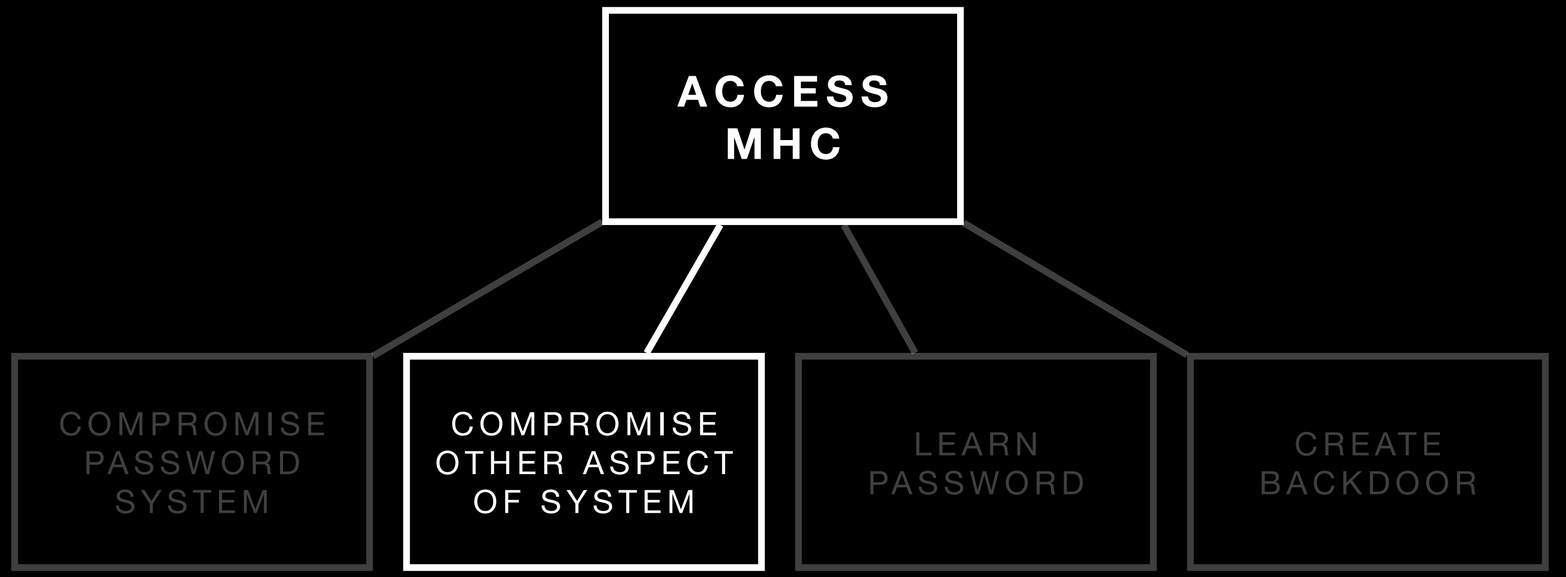

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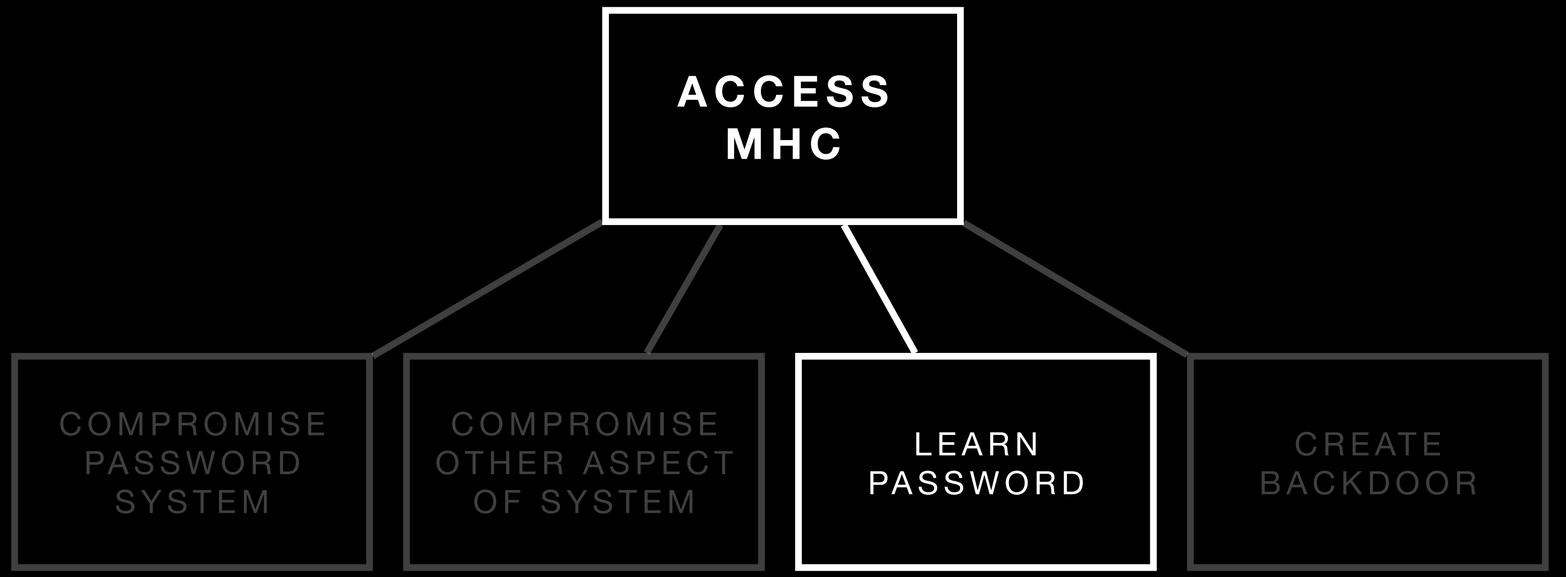

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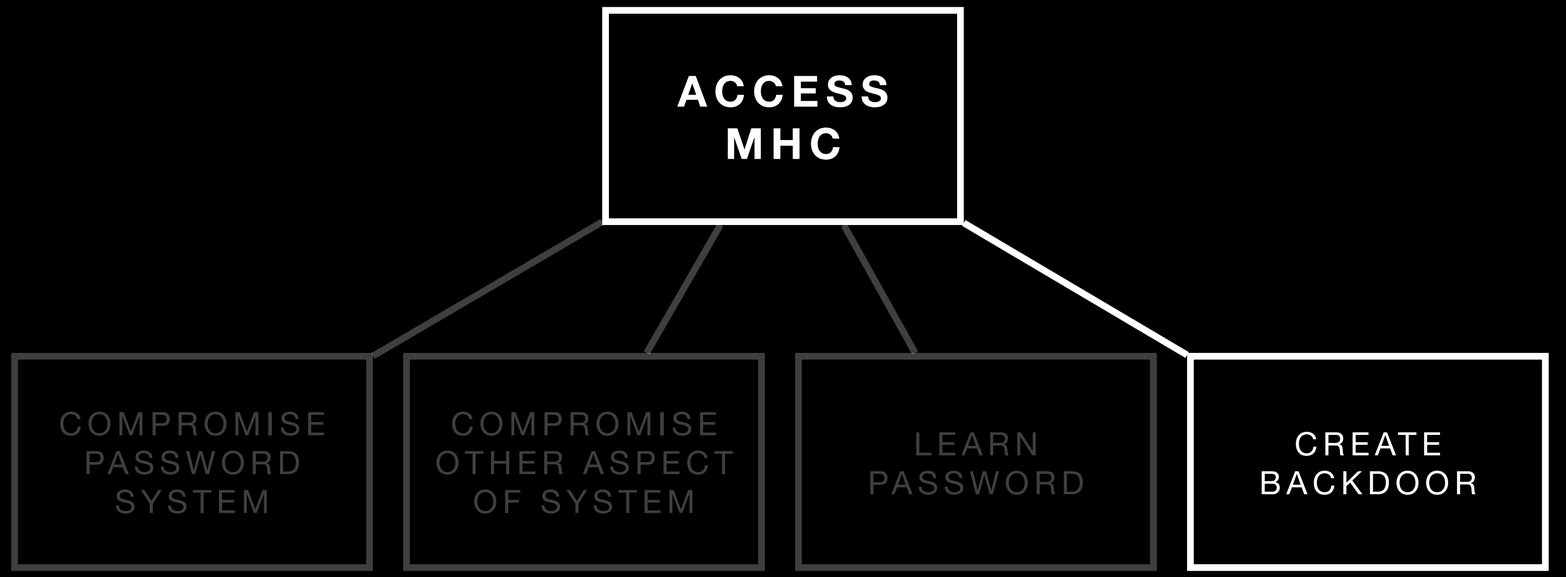

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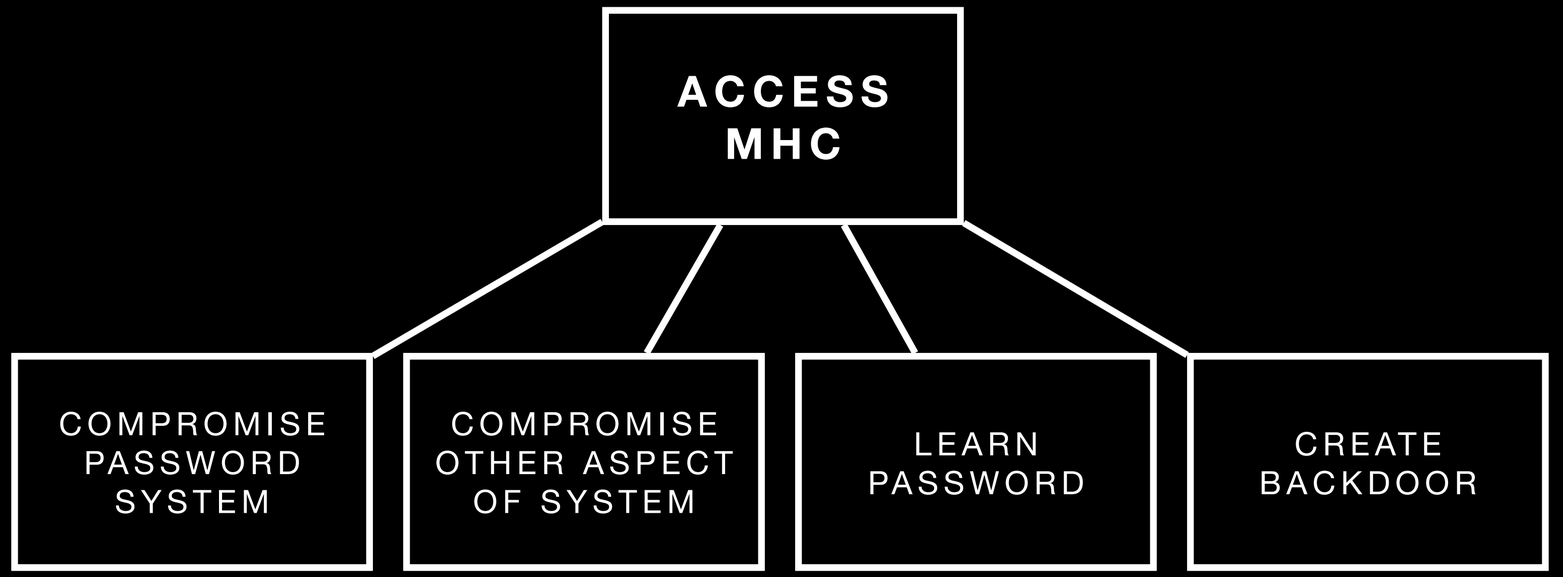

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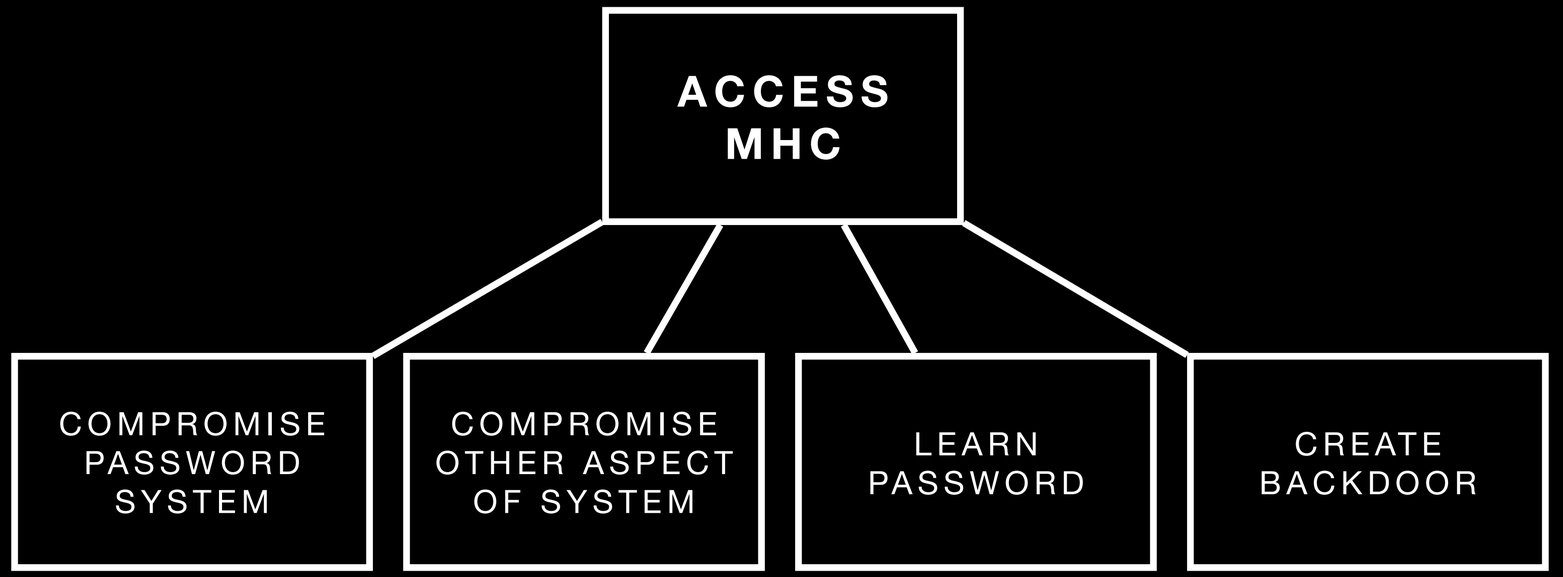

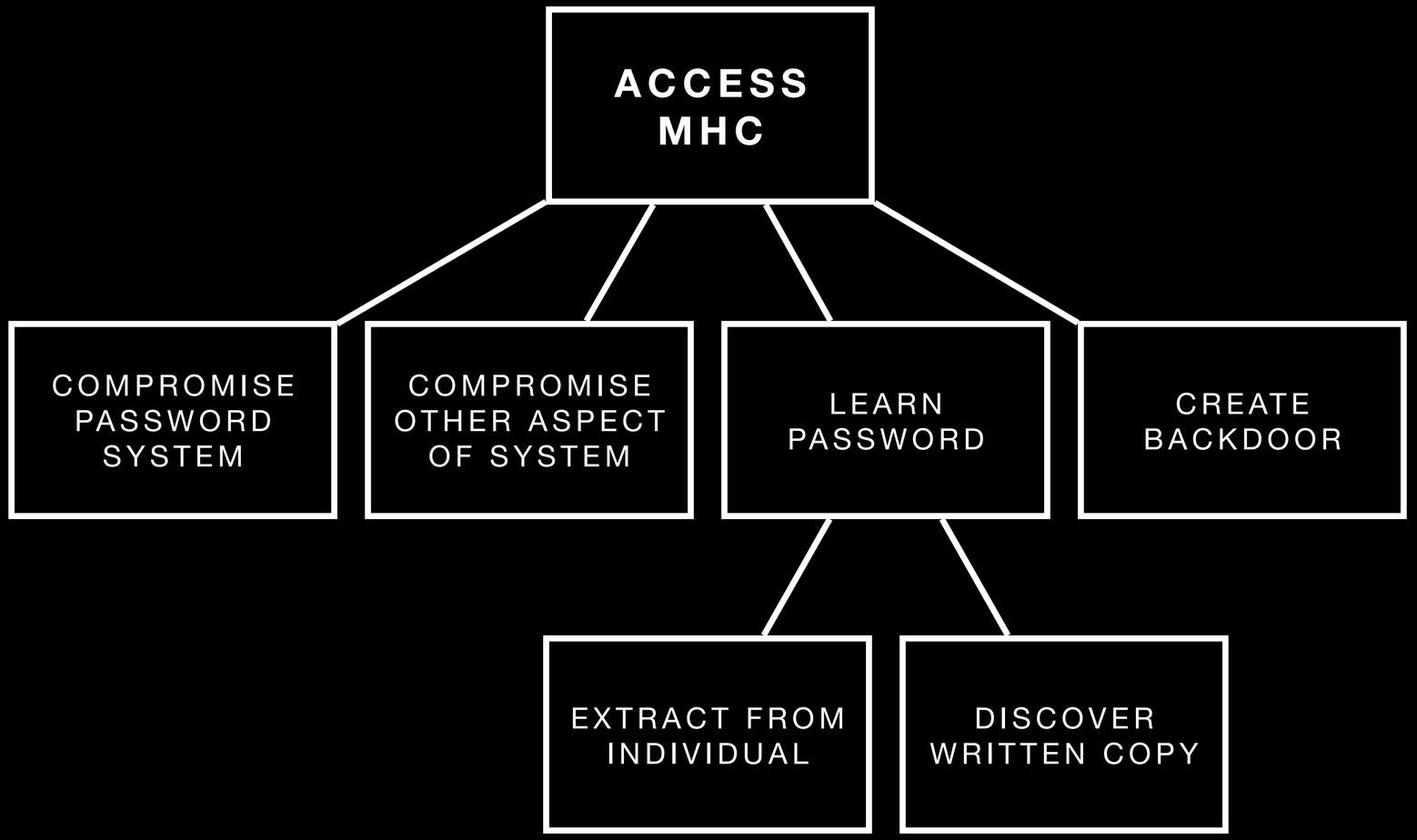
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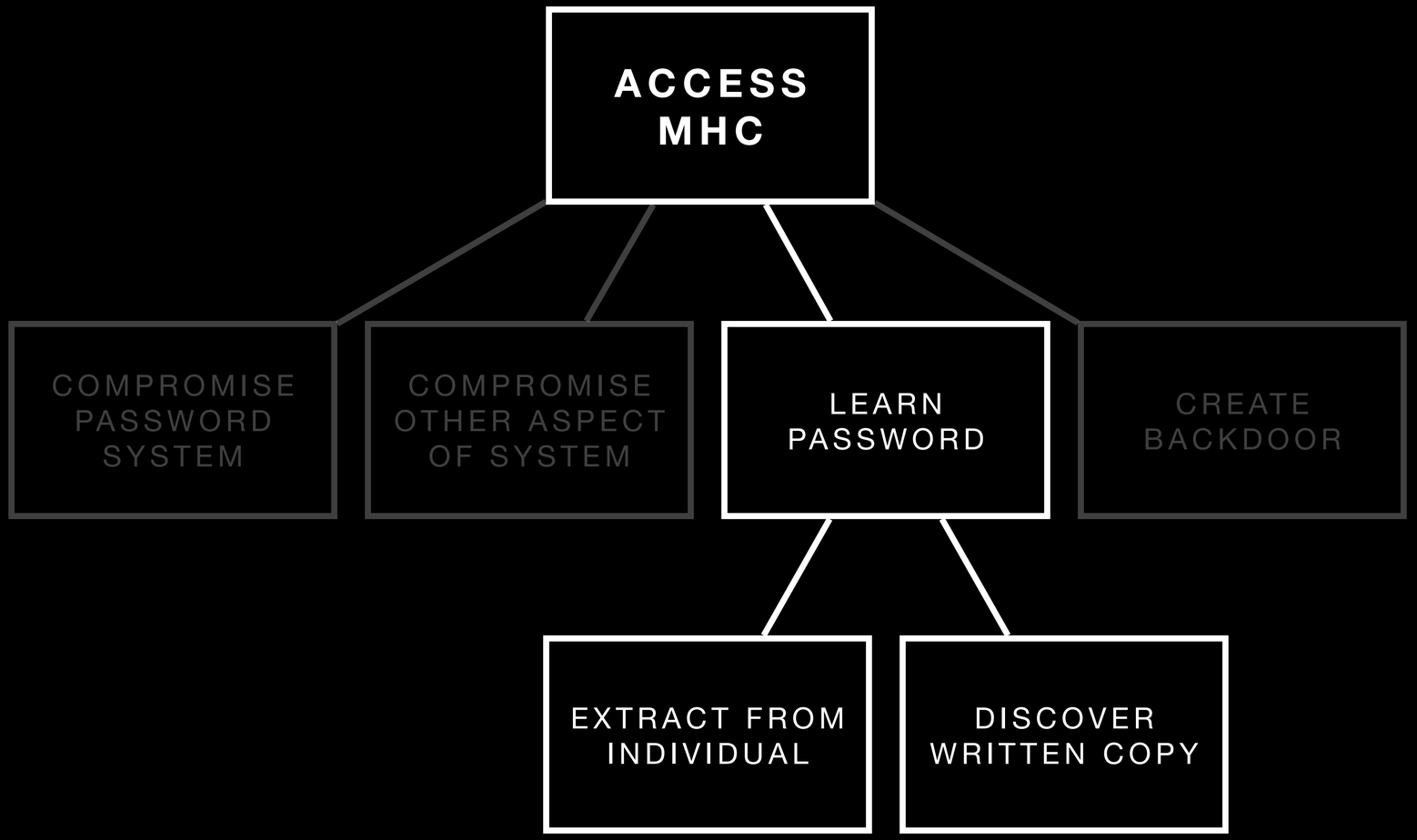
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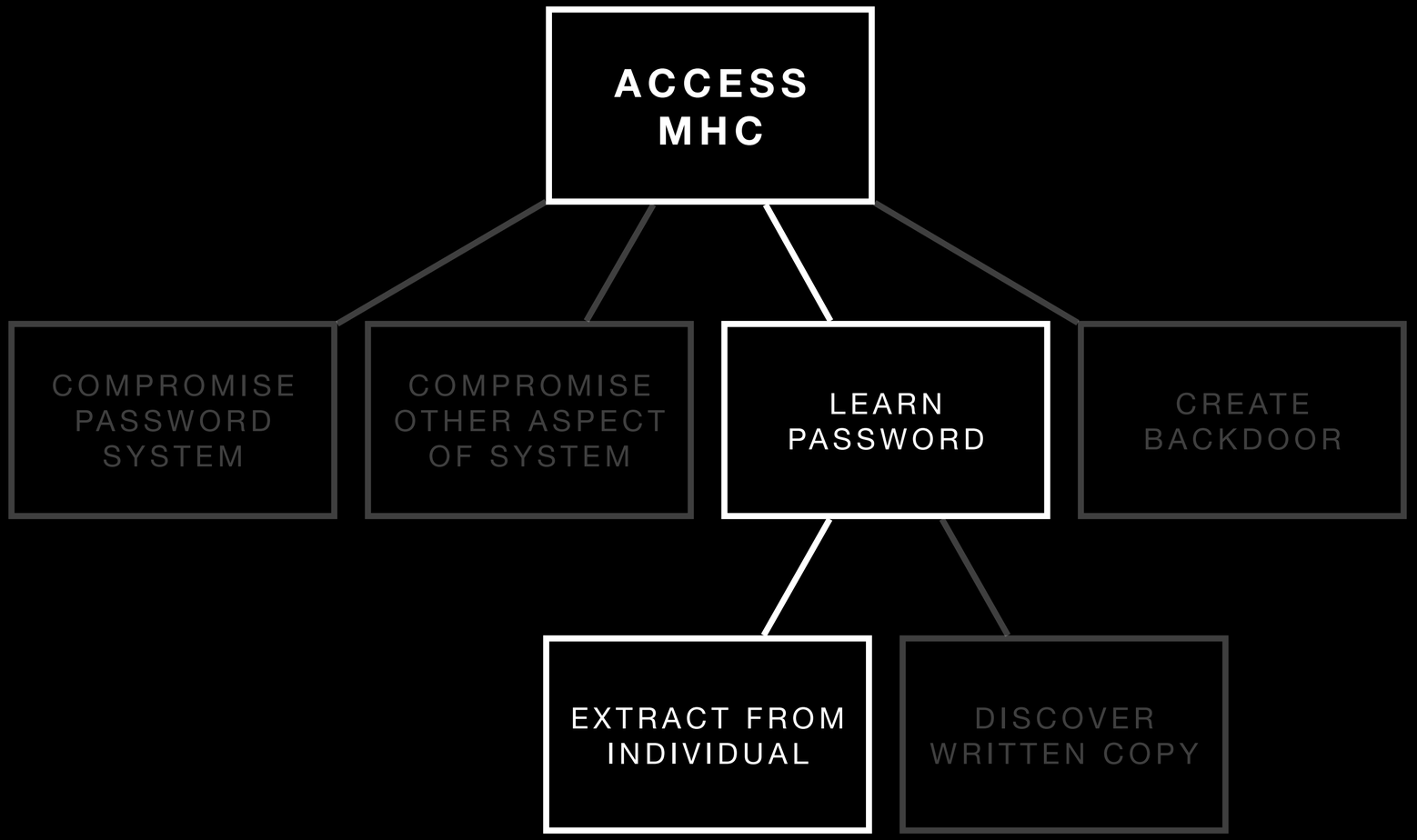
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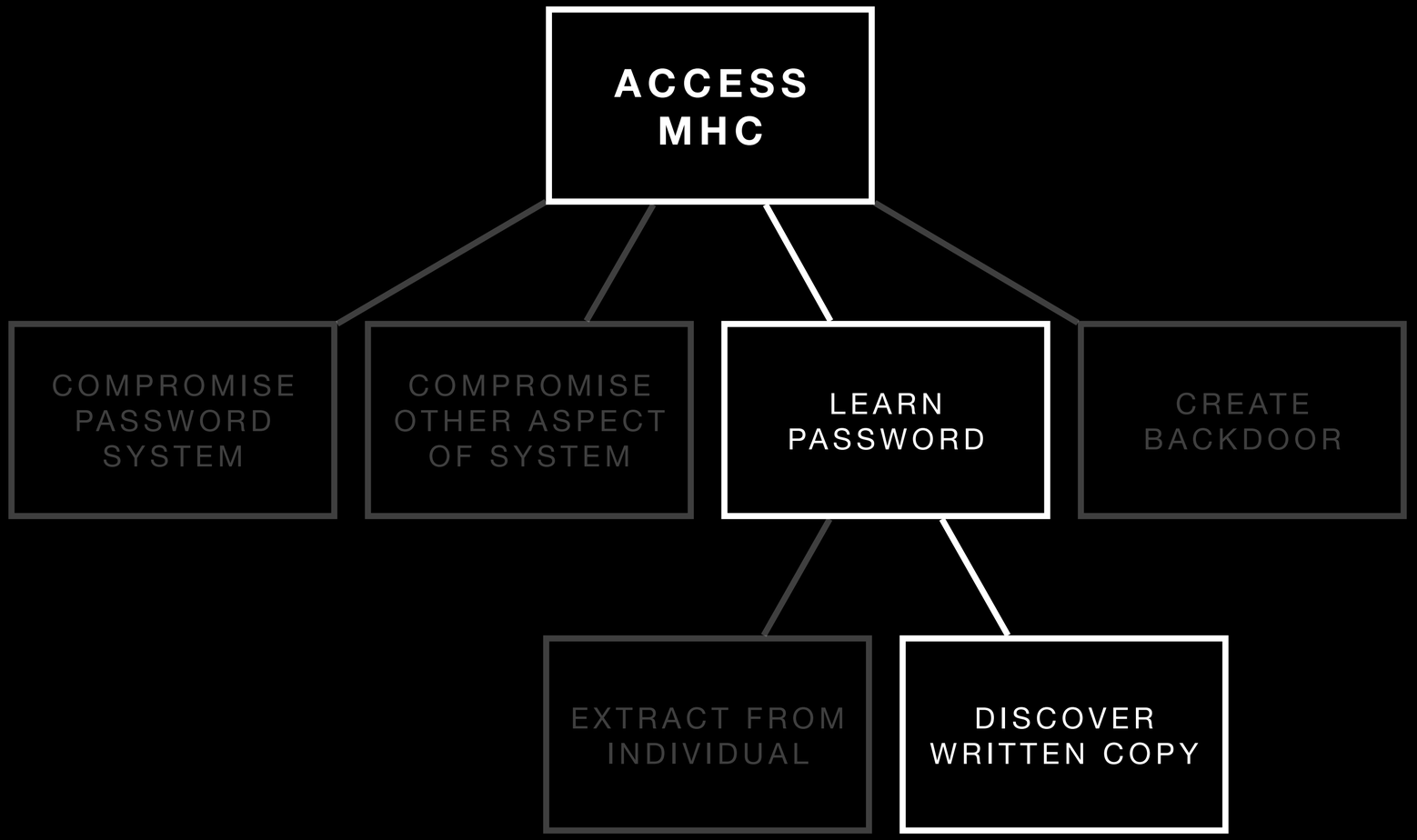
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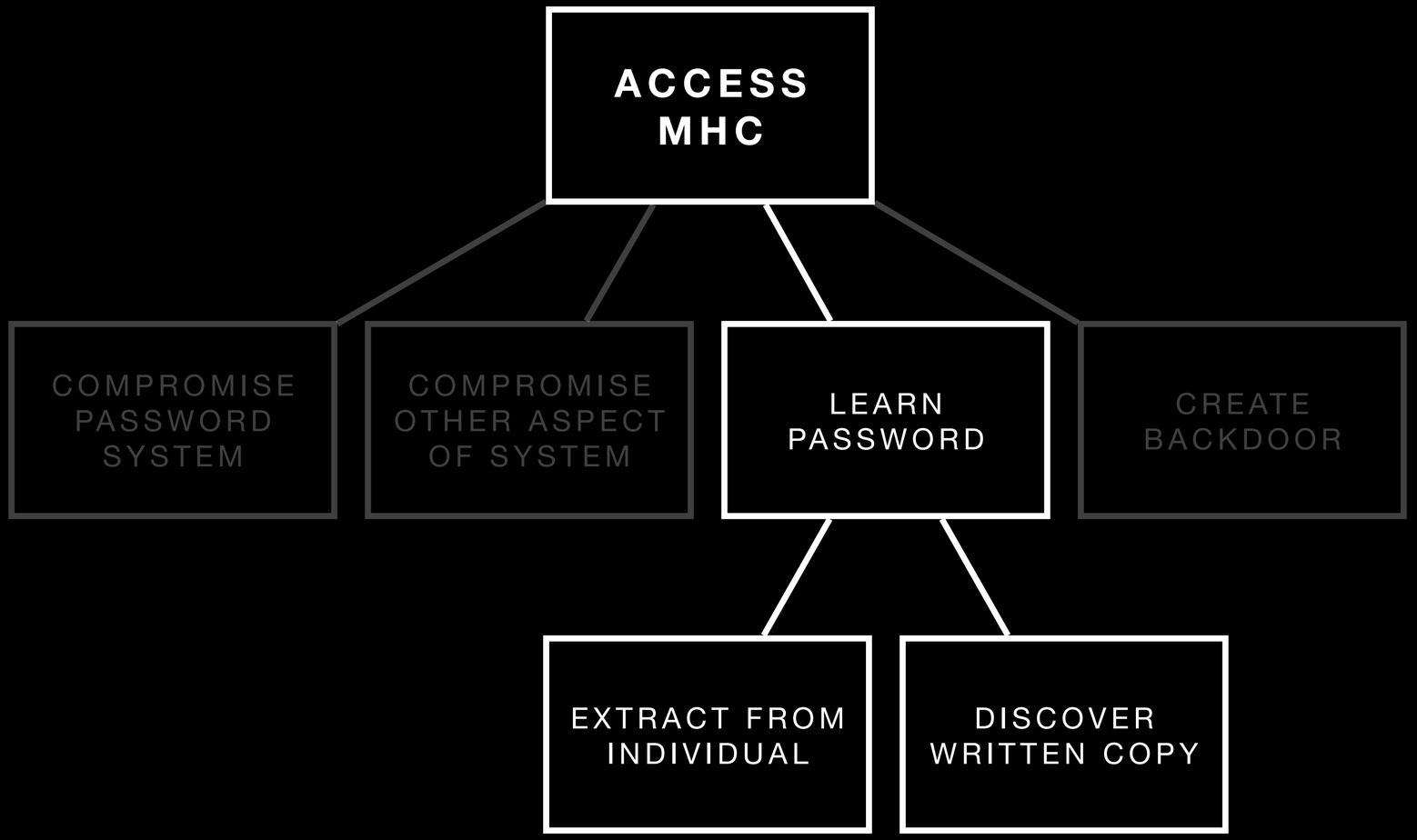
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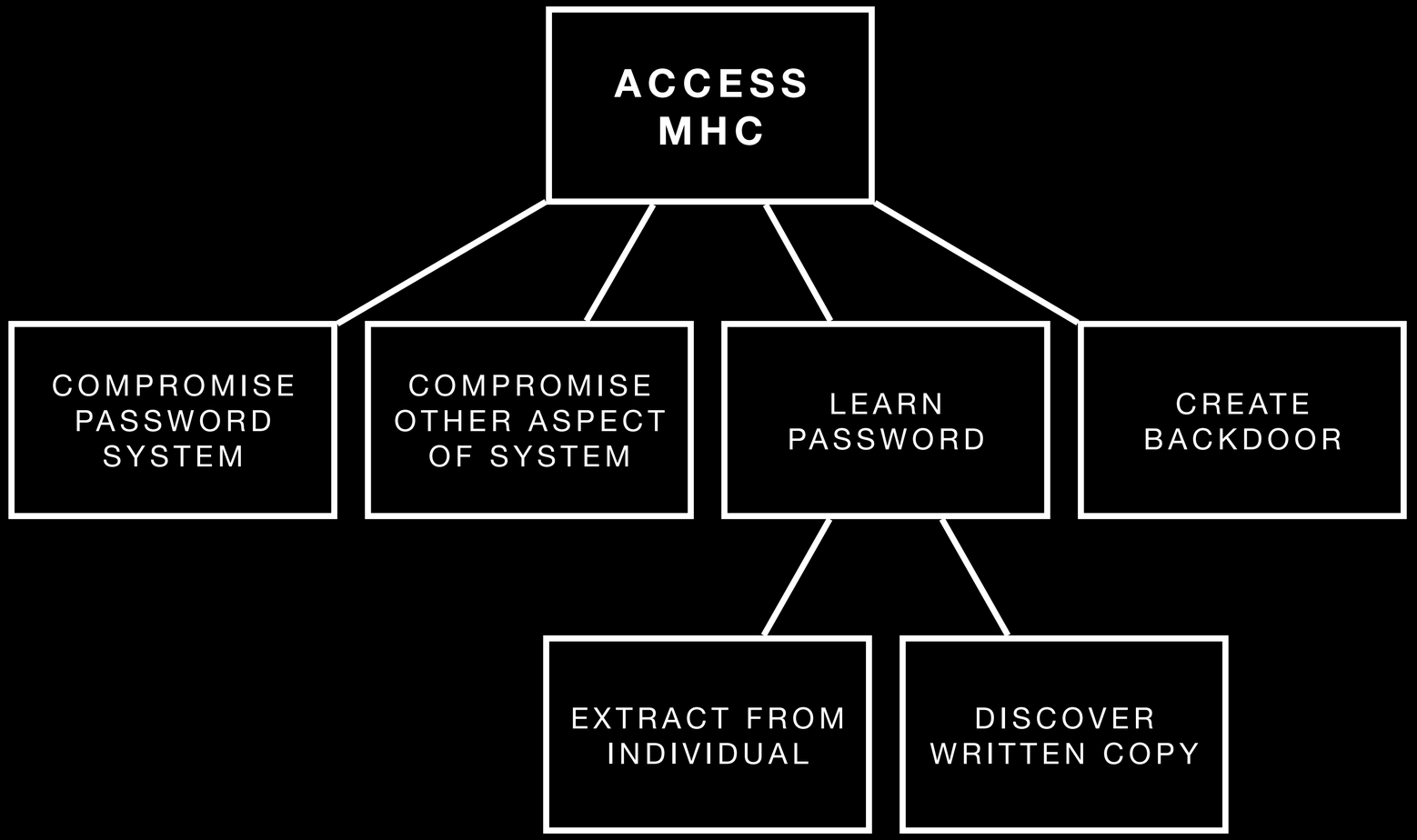
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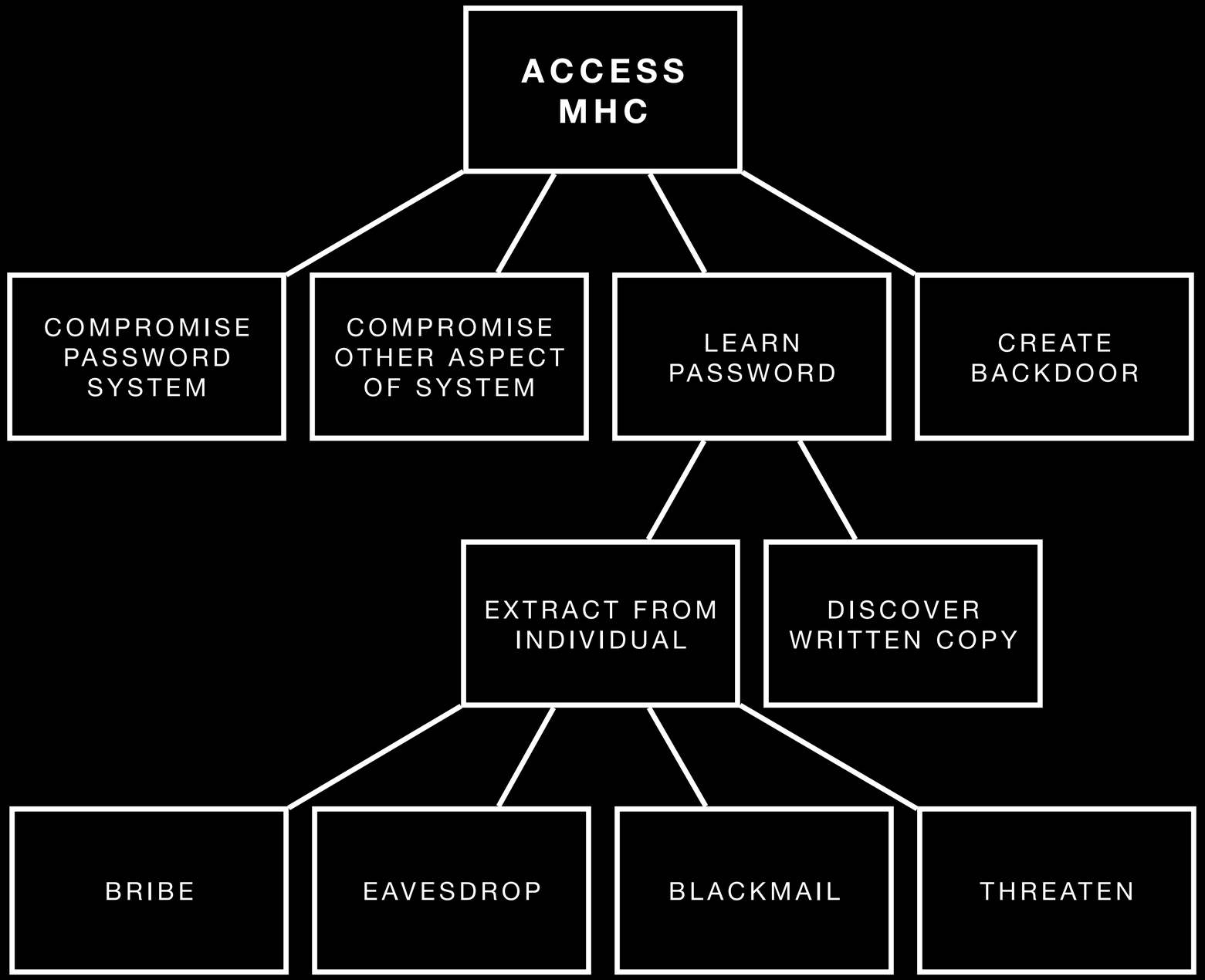
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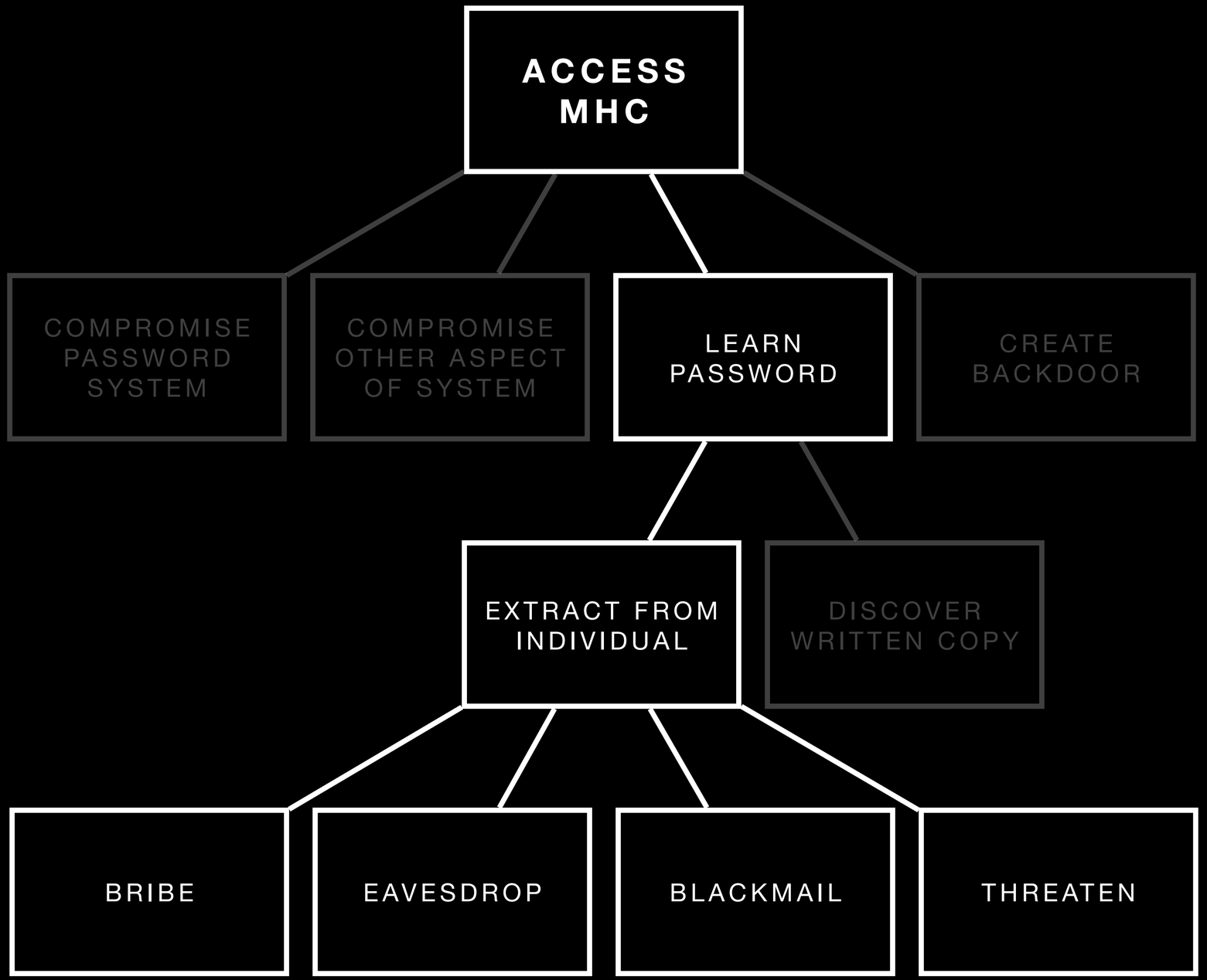
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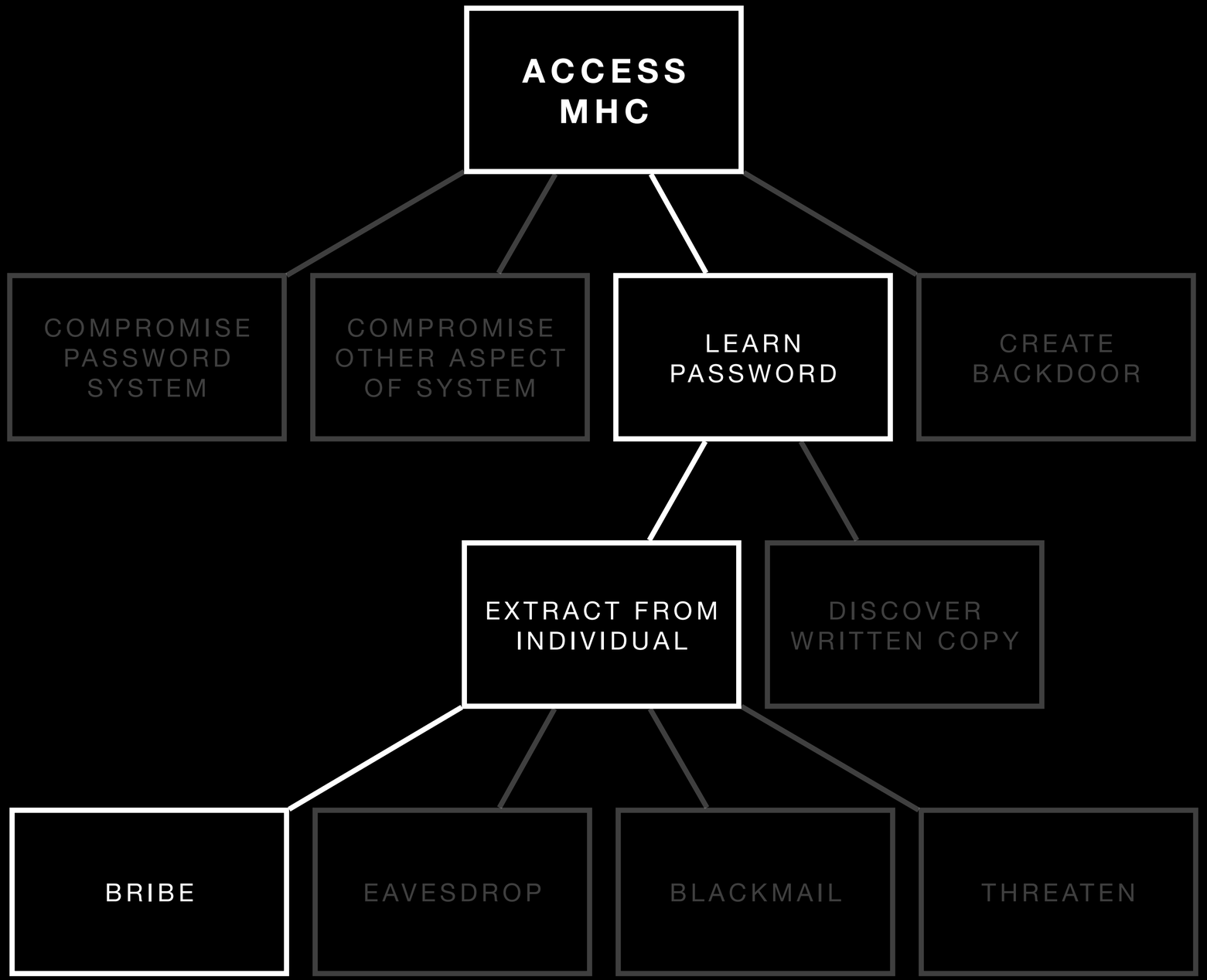
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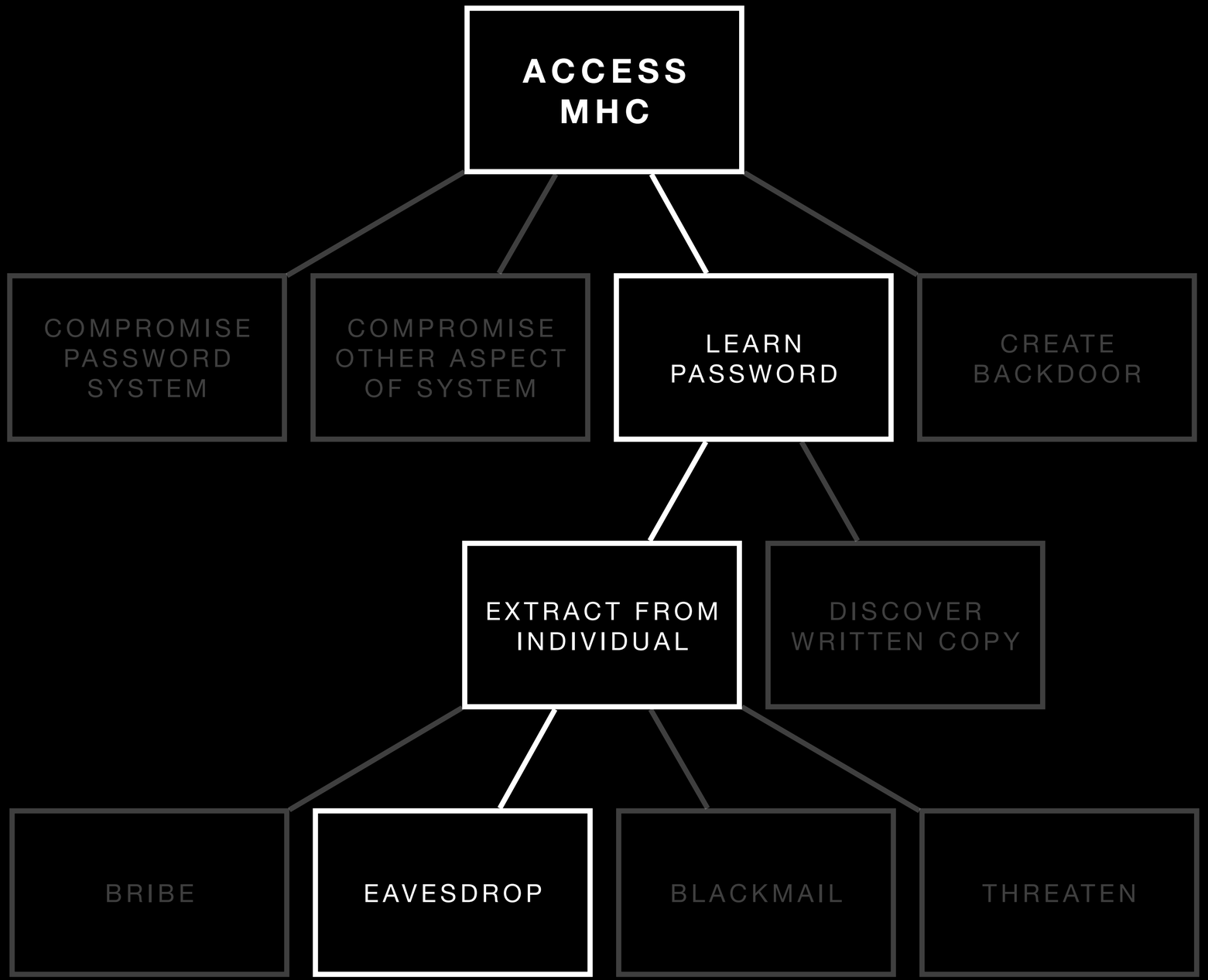
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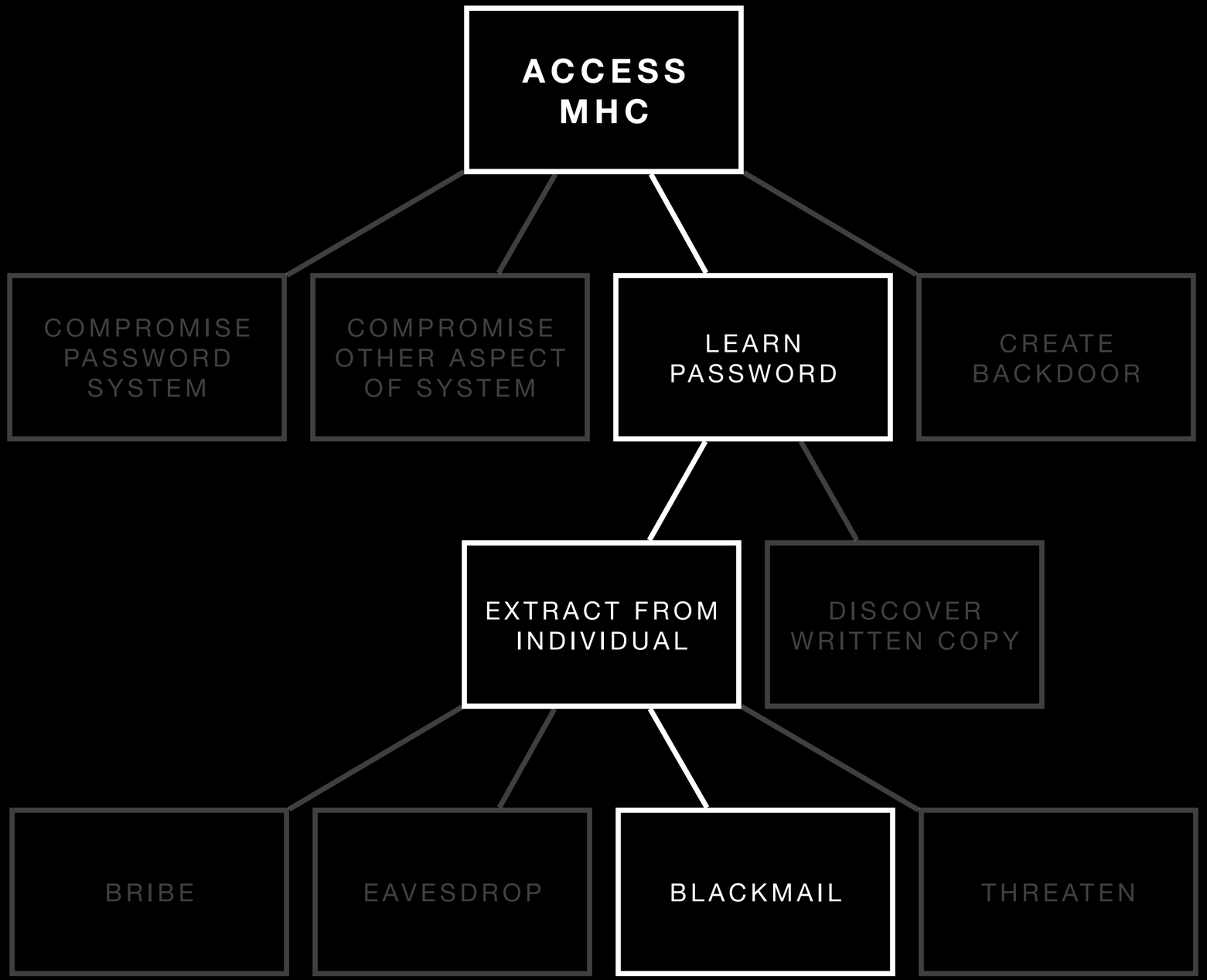
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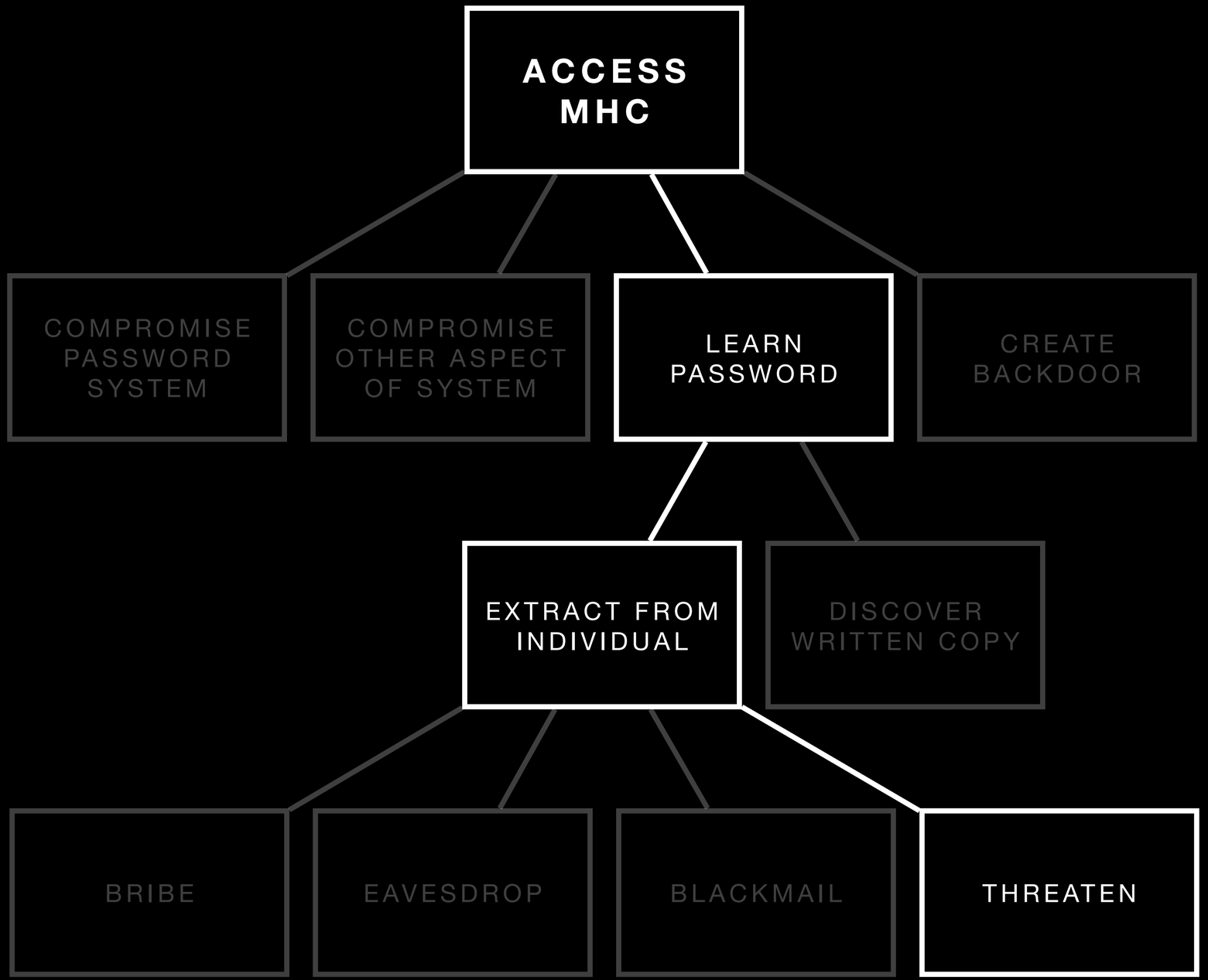
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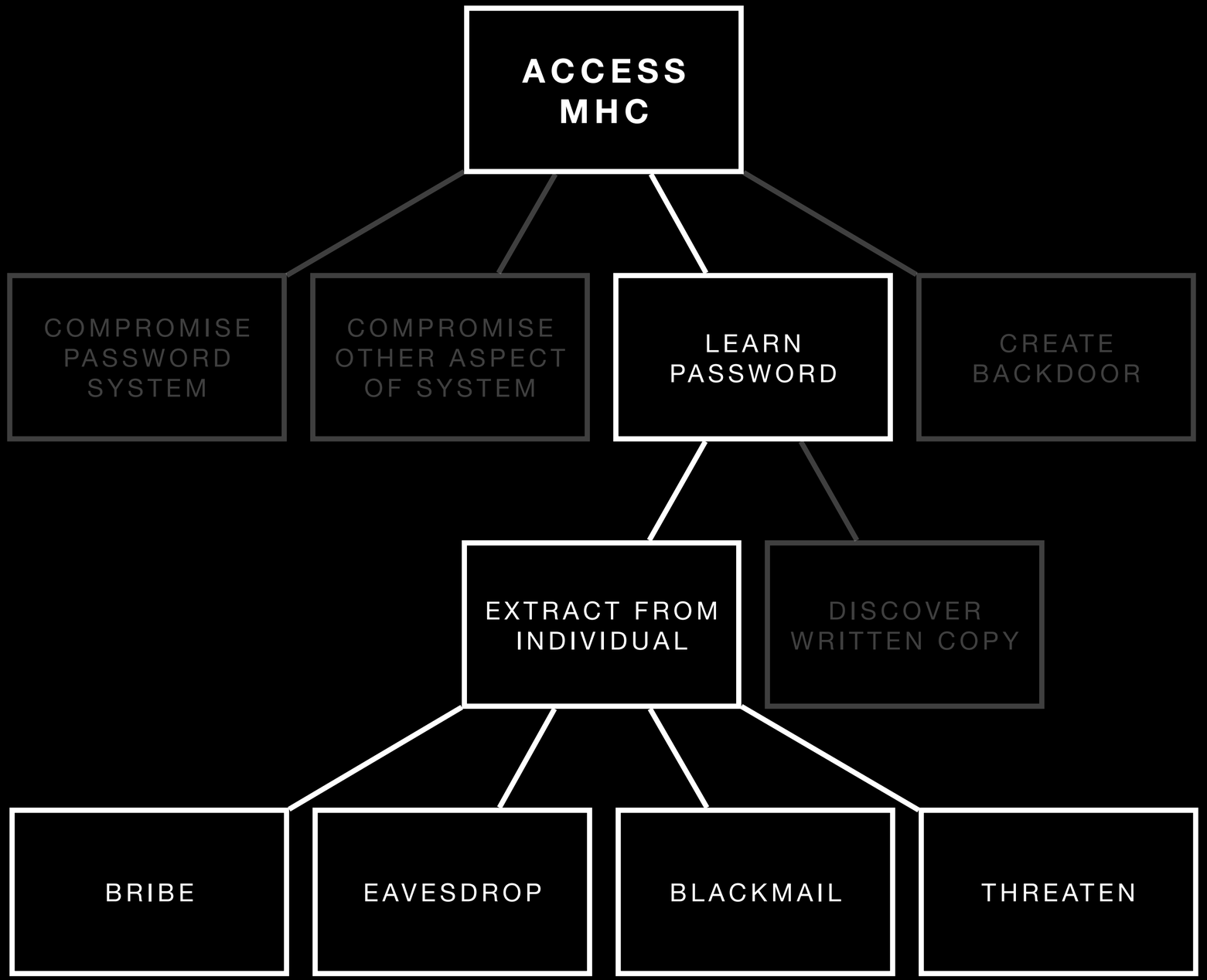
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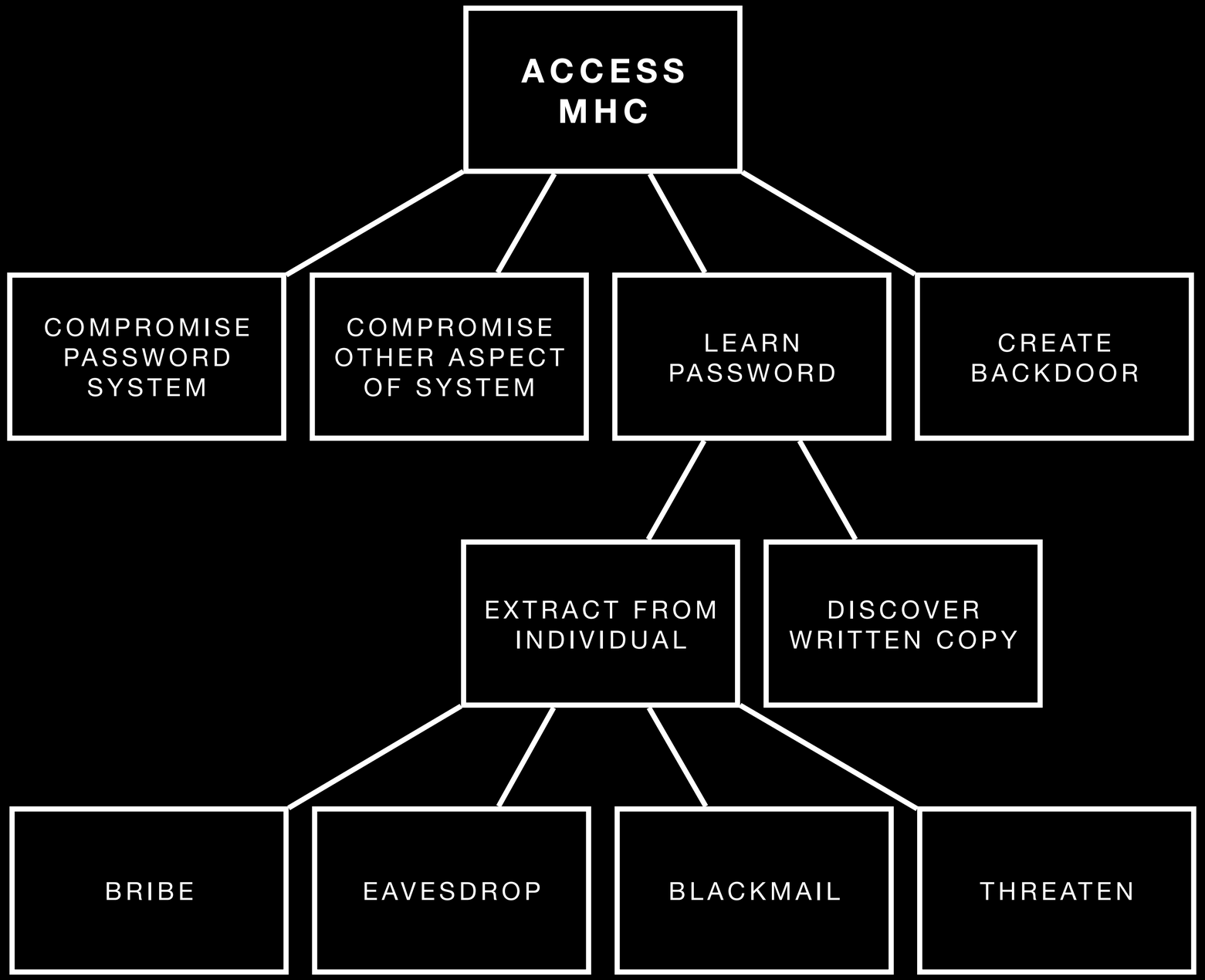
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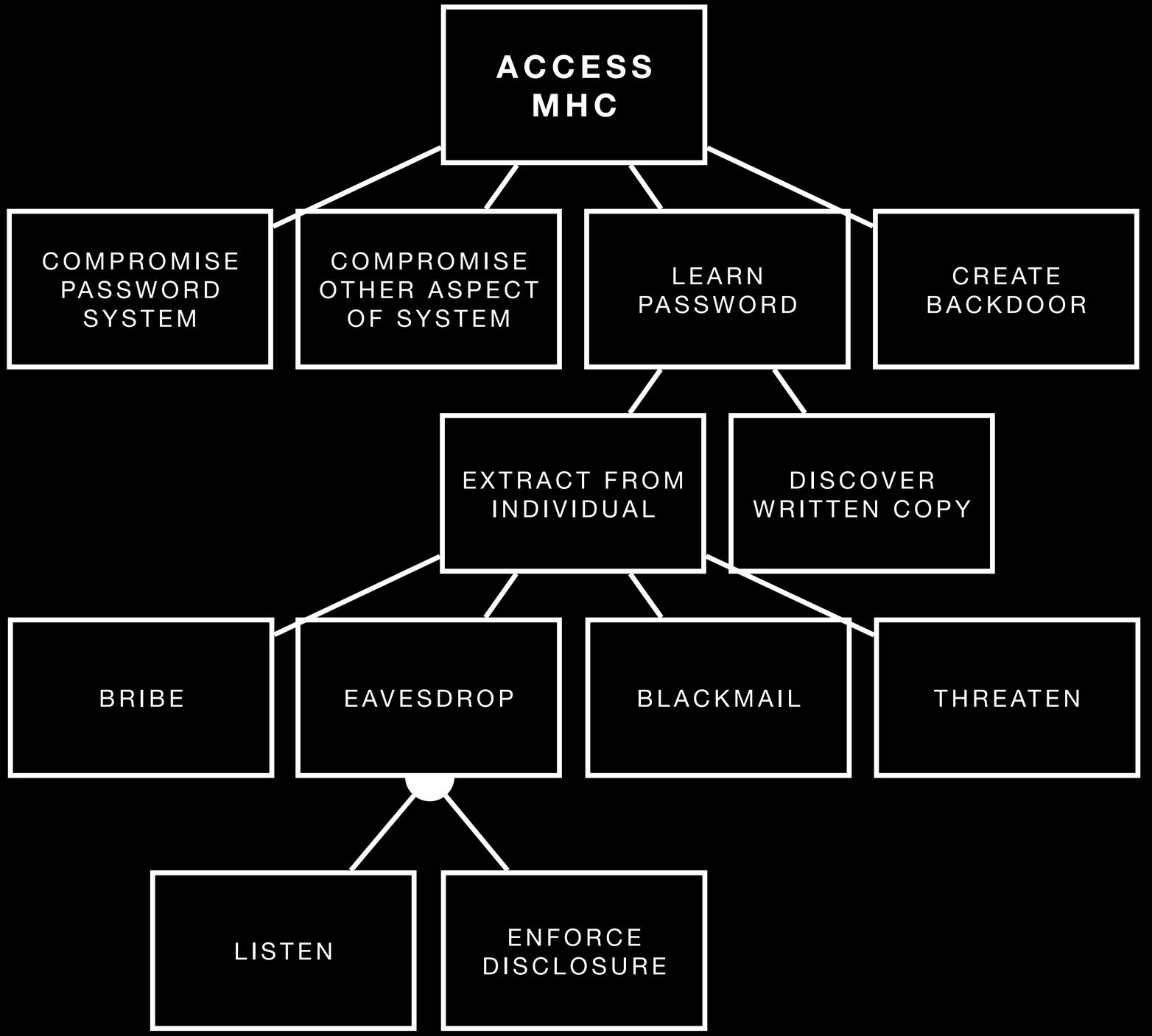
Logic
Attack Trees

- Attack nodes can be considered **AND** or **OR** attack nodes.
- **AND** as combinations that have to happen to achieve each goal.
- **OR** as options or alternatives to achieve each goal.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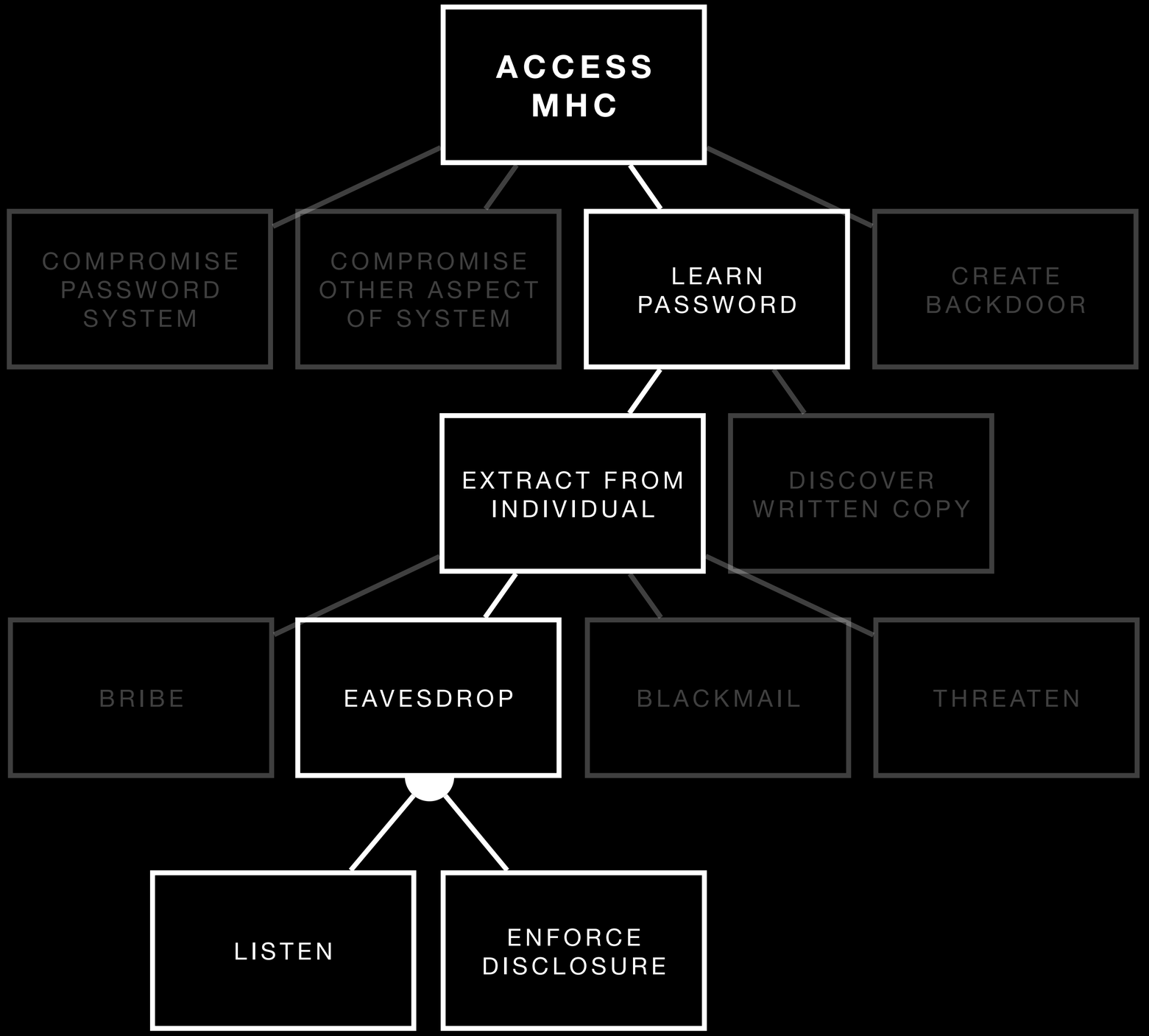
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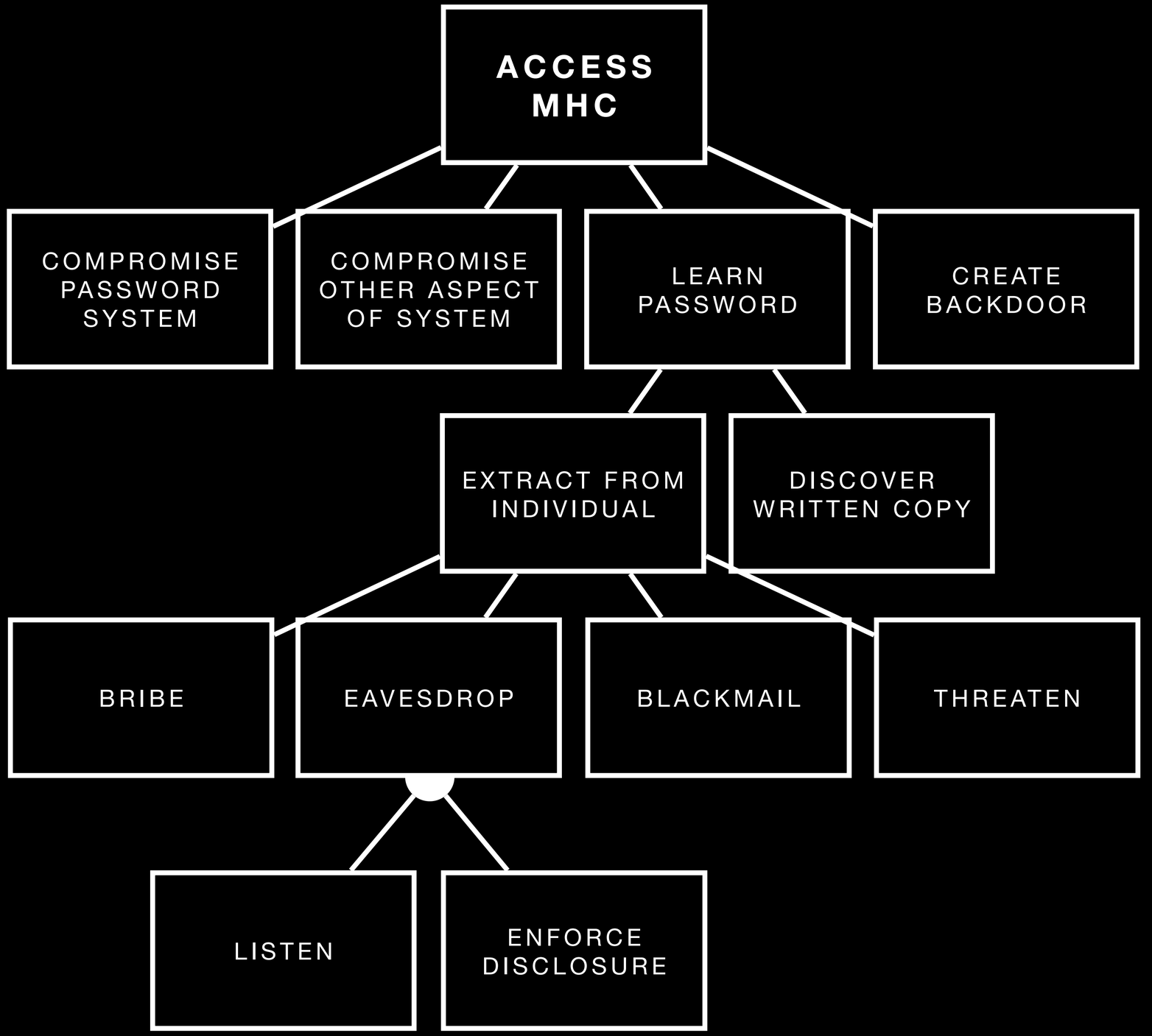
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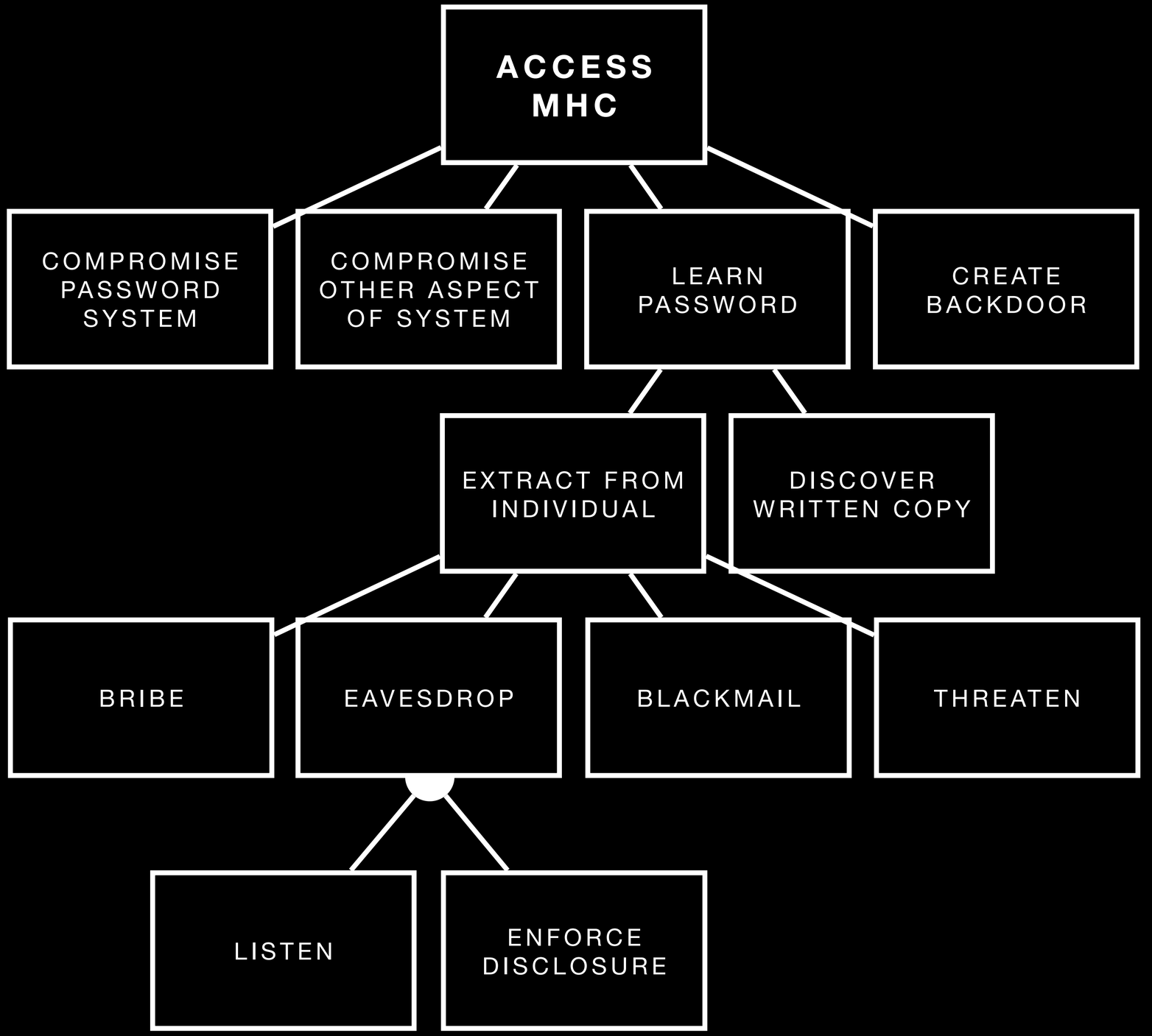
Impossible vs Possible

Attack Trees

- Constructed simple attack tree, consider the possibility of each attack node.
- Some attack nodes after research may be deemed impossible.
- Alternatively after some consideration some attack notes may be considered possible.
- Label attack tree to indicate whether an attack node can be considered possible or impossible.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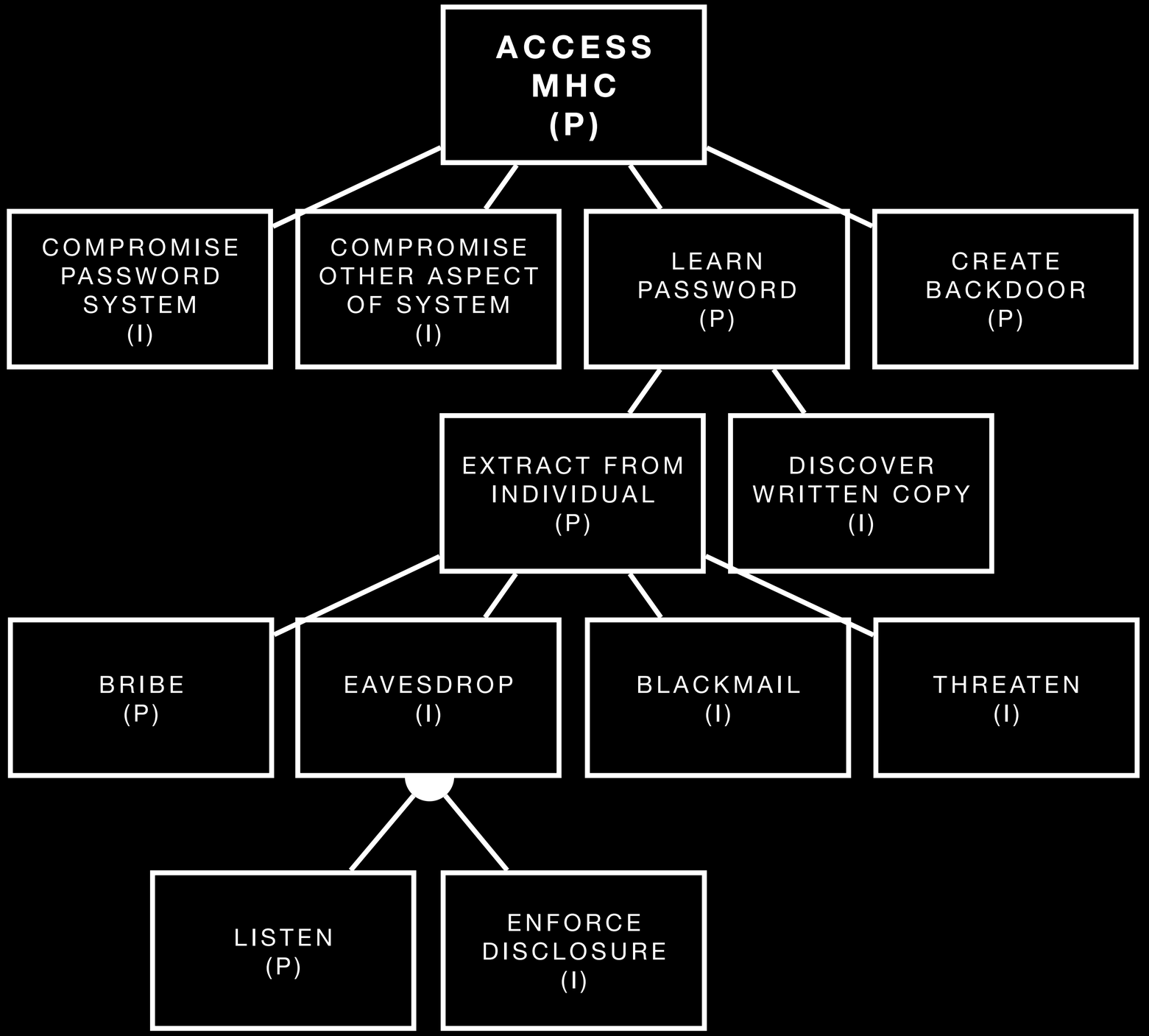
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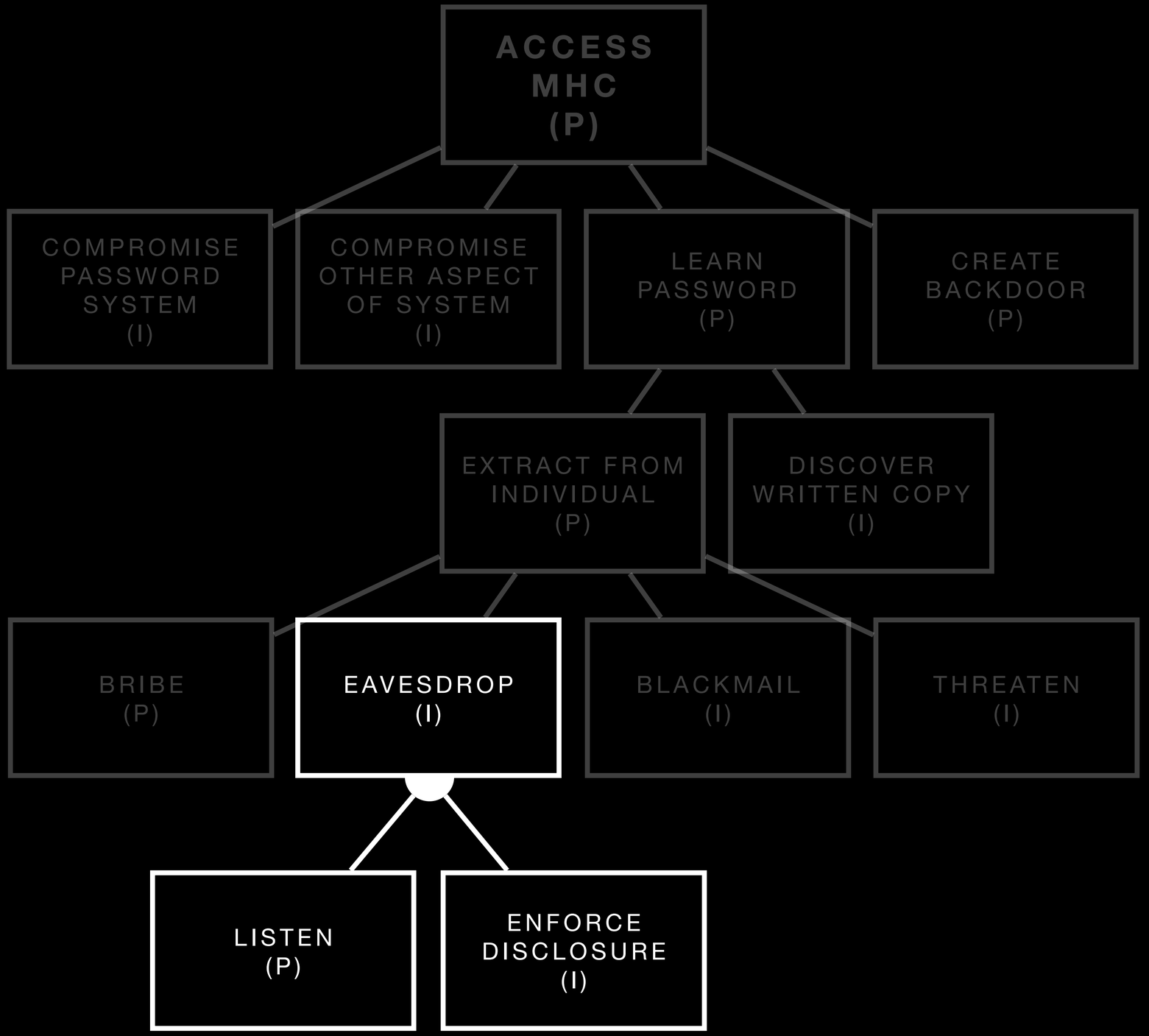
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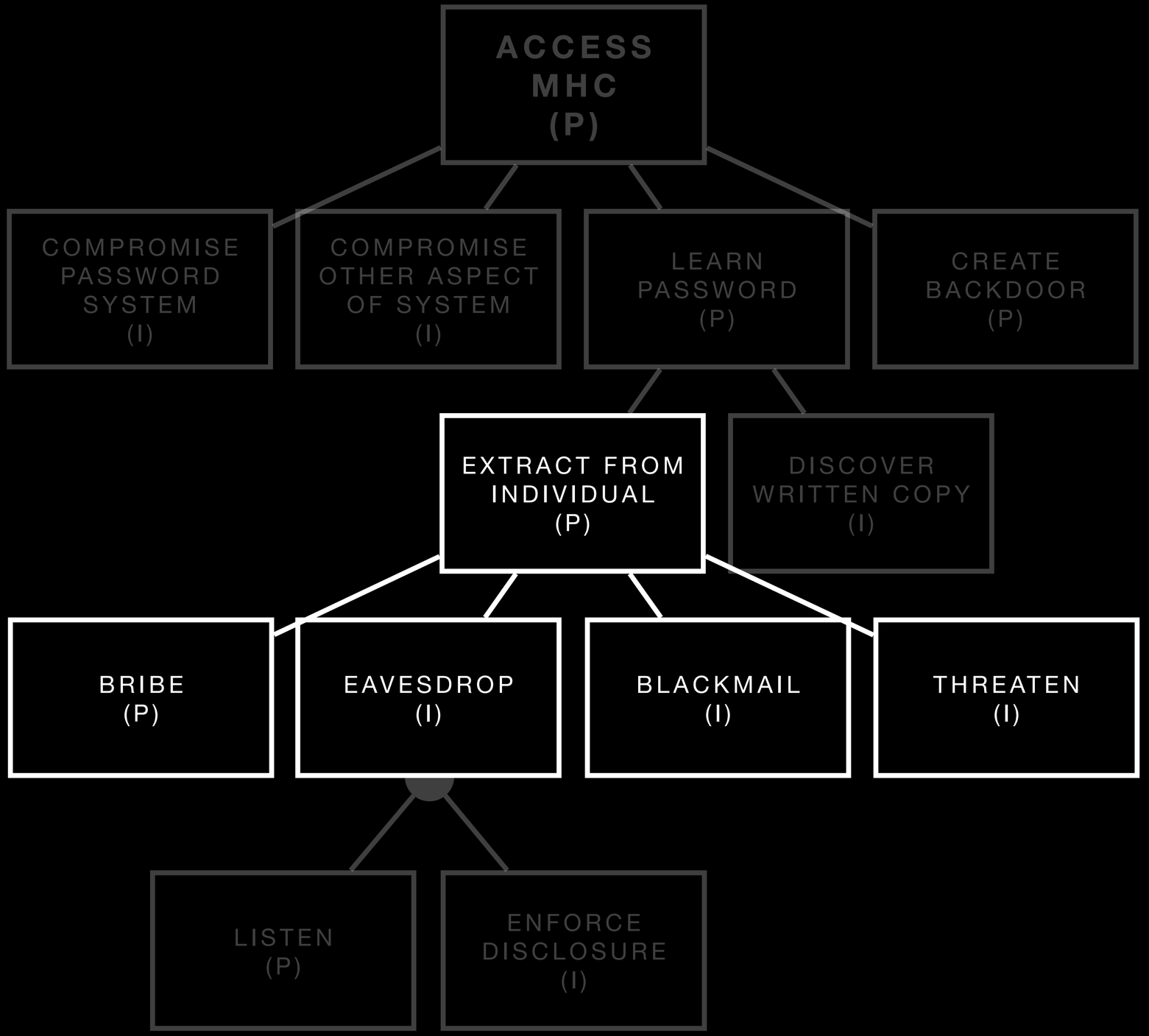
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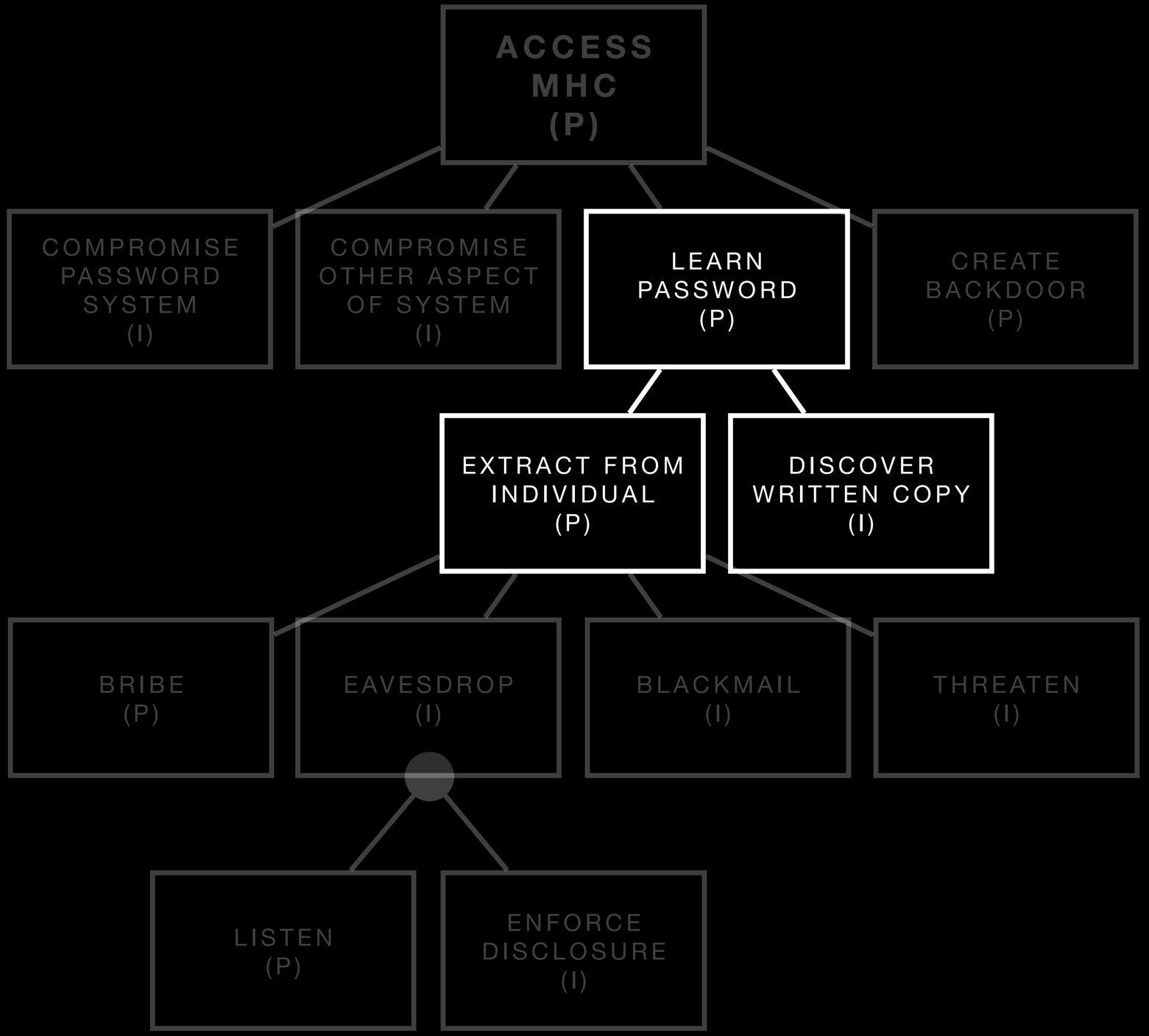
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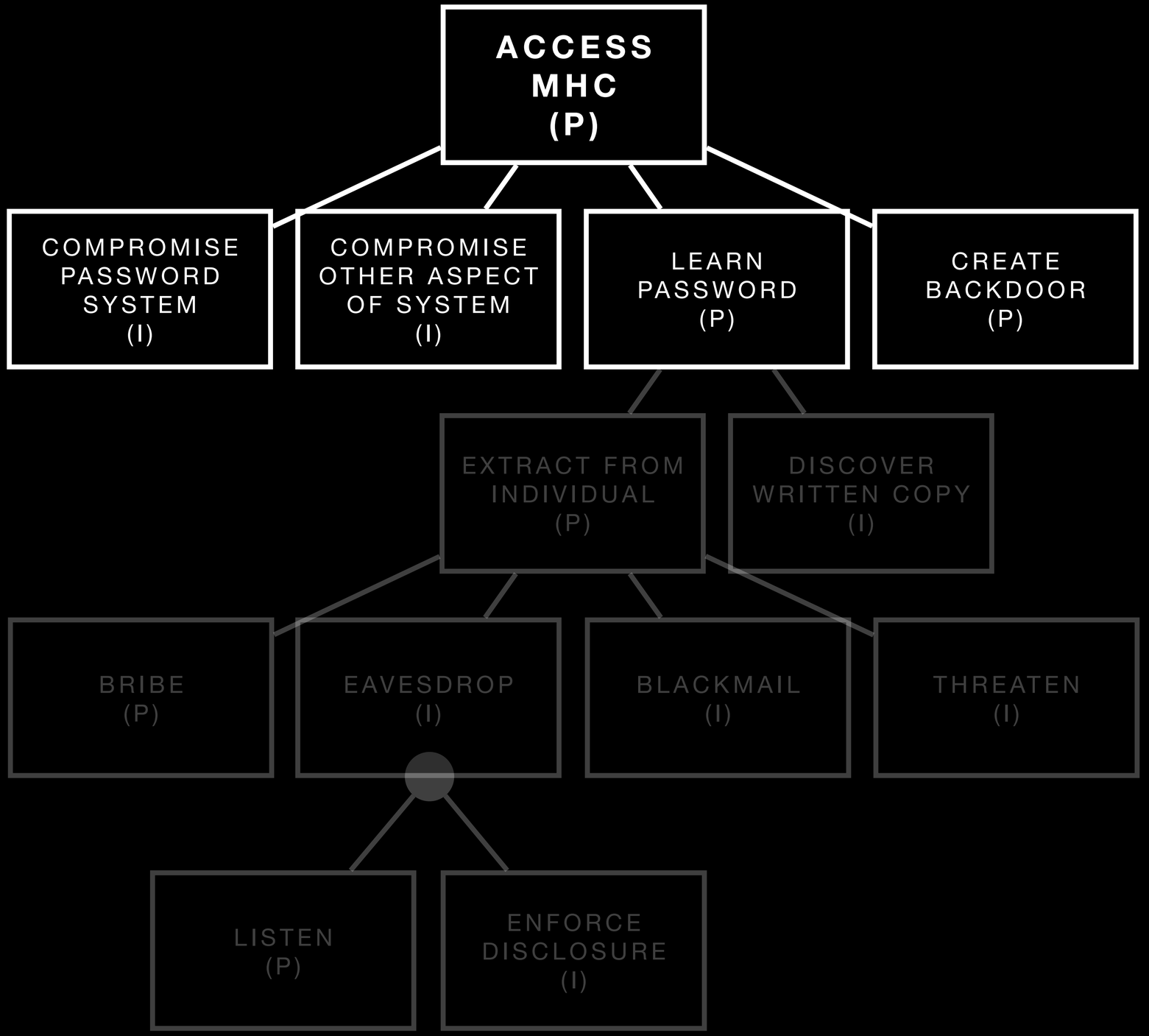
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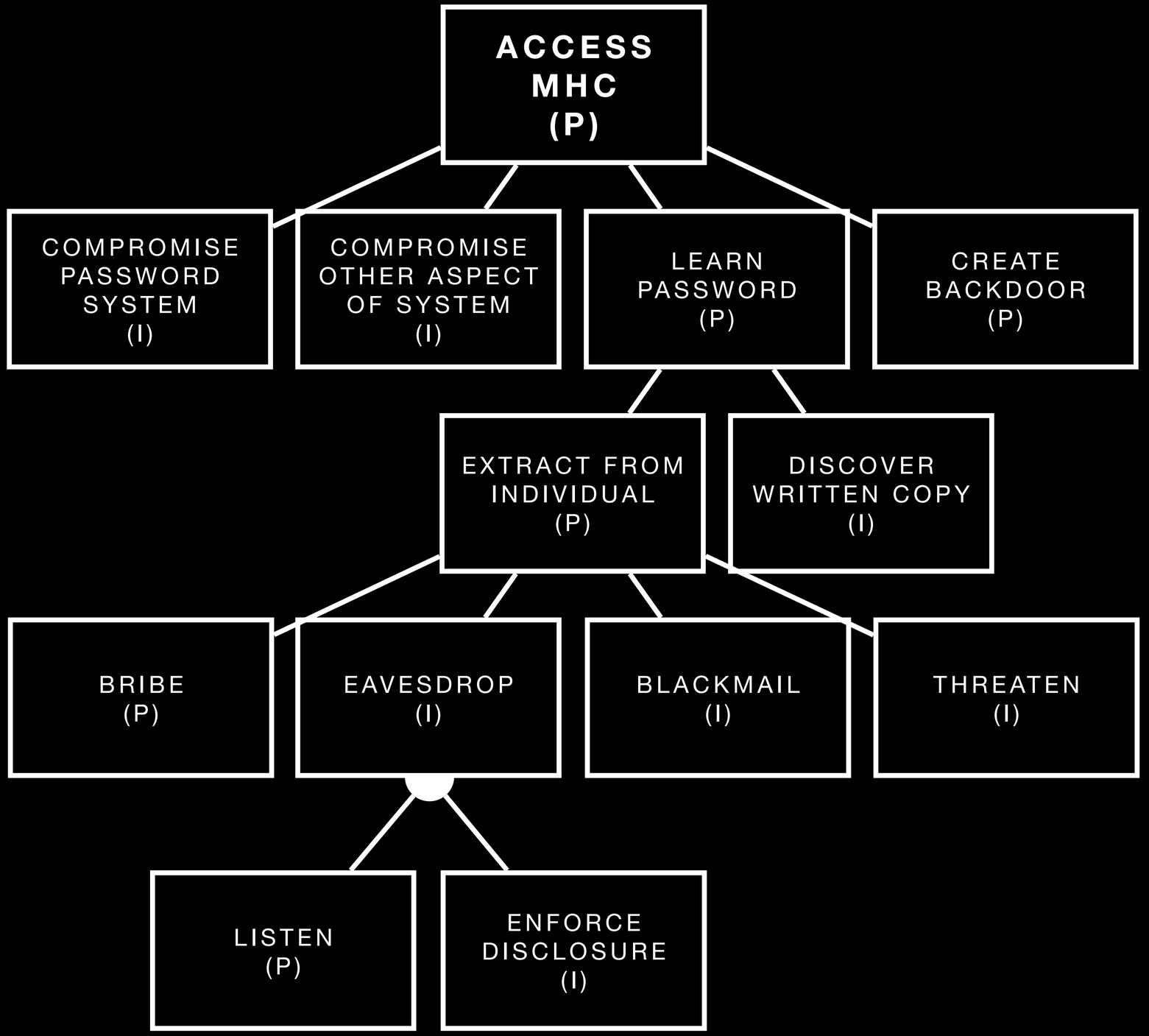
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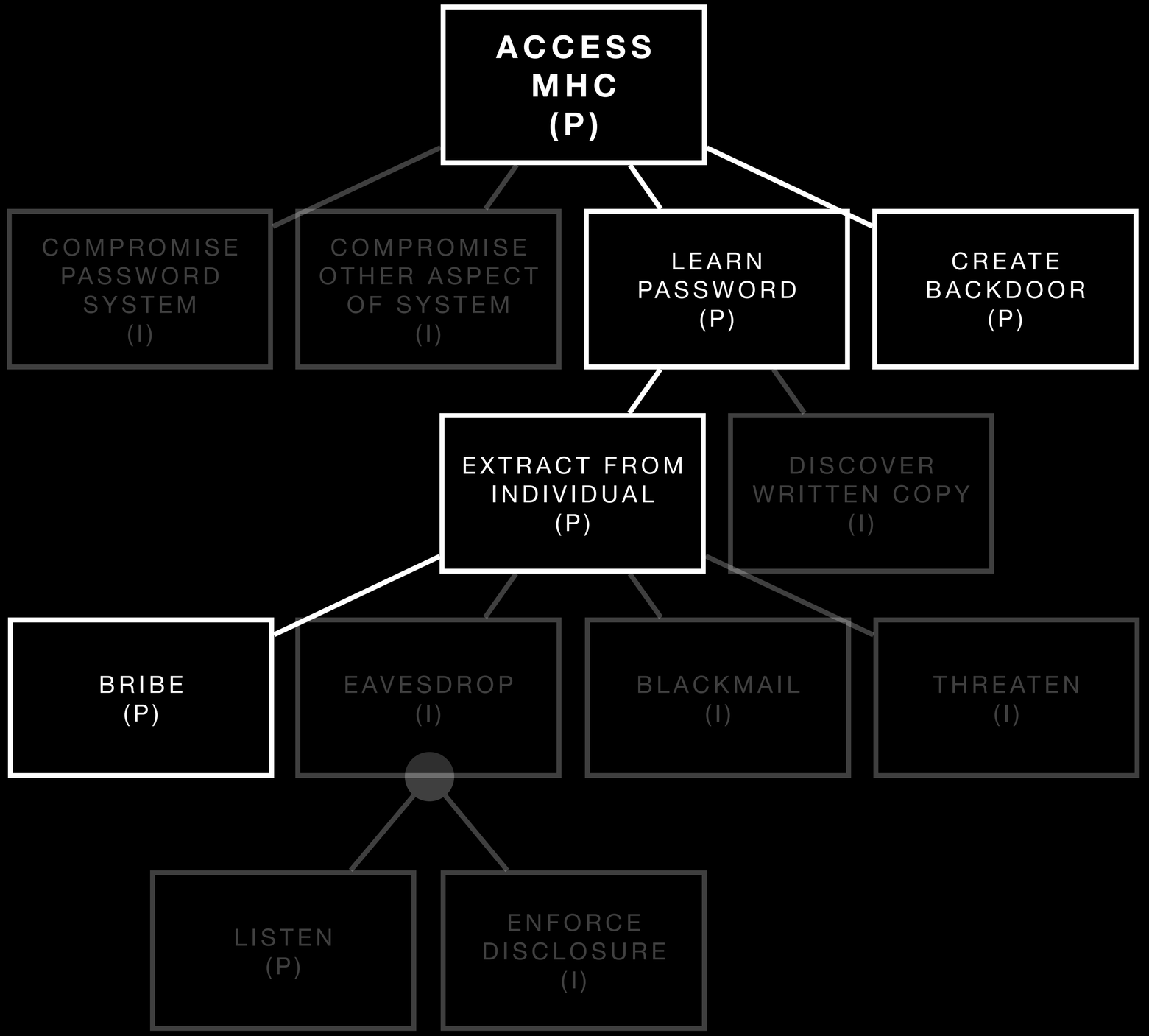
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Impossible vs Possible

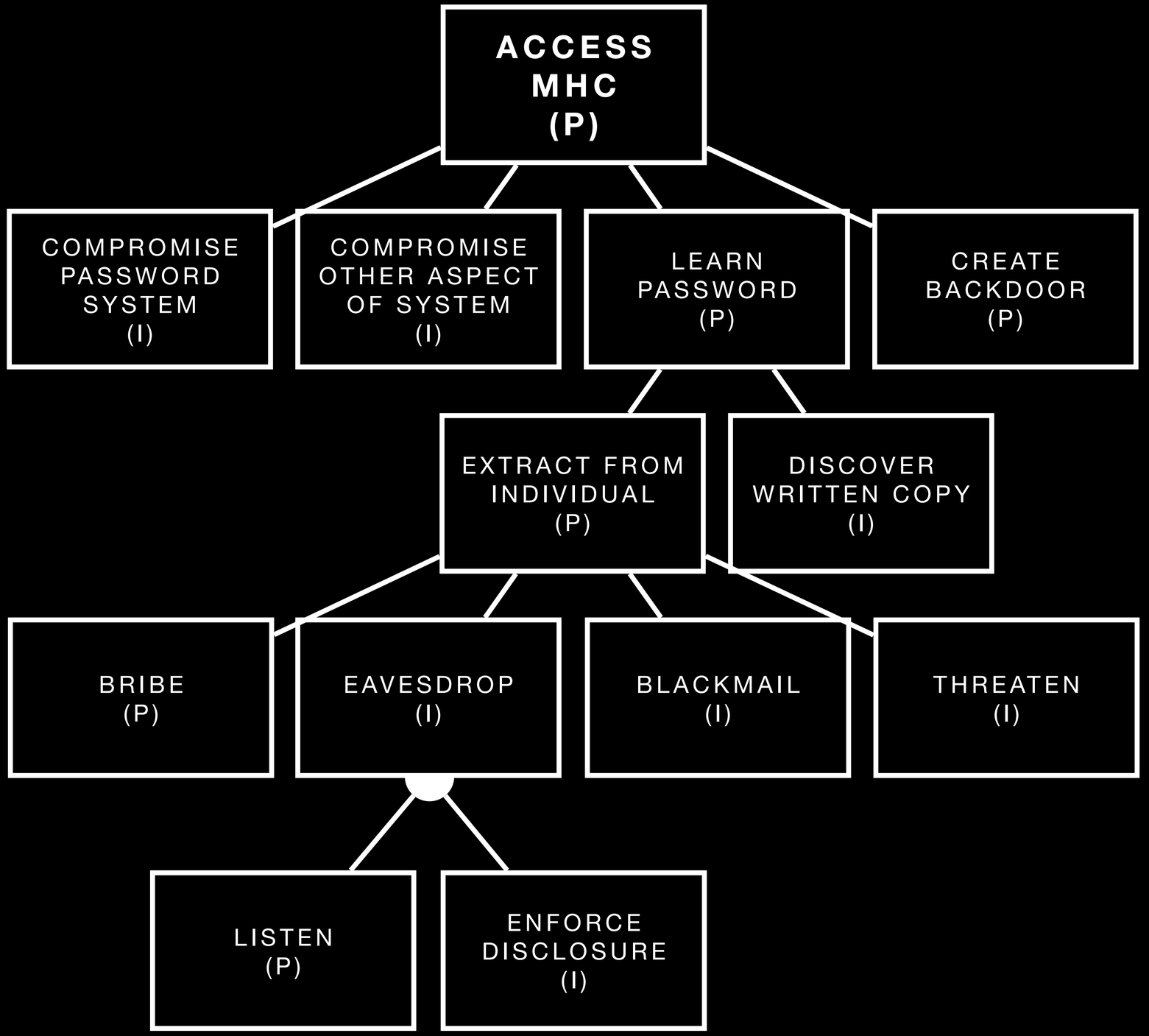
Attack Trees

- Labelling attack nodes as impossible or possible is relatively simplistic, but is easy to communicate and comprehend.
- Can adopt alternative boolean values, labels or construct multiple attack tress with various different labels or values.
- Possible attack tree could assign actual monetary expense and assessment could be determined using these values.

Perspectives

Attack Trees

- Multiple attack trees can be created to consider attacks from multiple adversaries.
- Recall, potential threats really are limited by the capability of the attacker.
- Organisation or company may be interested in the least expensive attack a hungry individual could mount.
- Similar, they may be more interested in threats from highly capable sources.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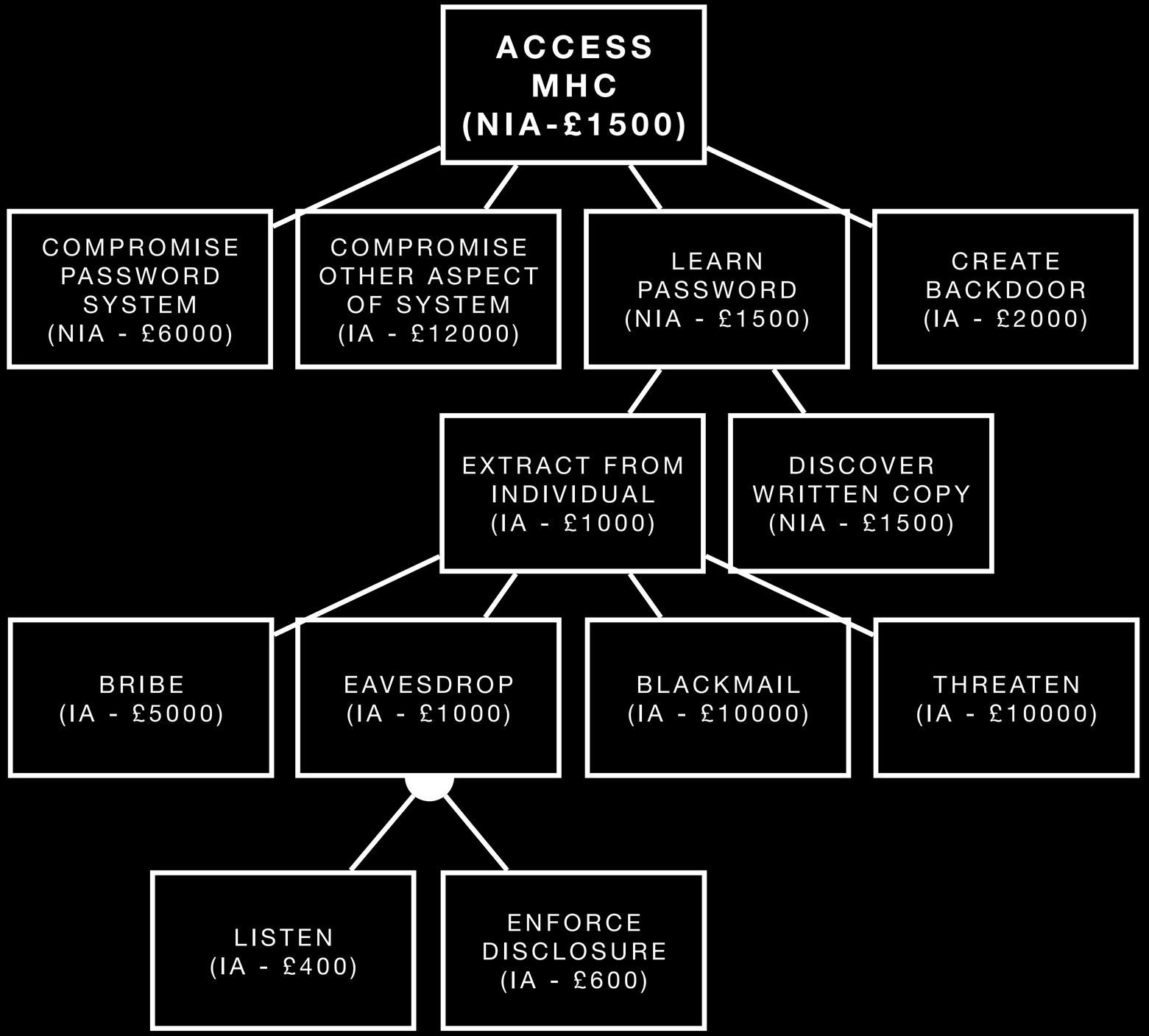
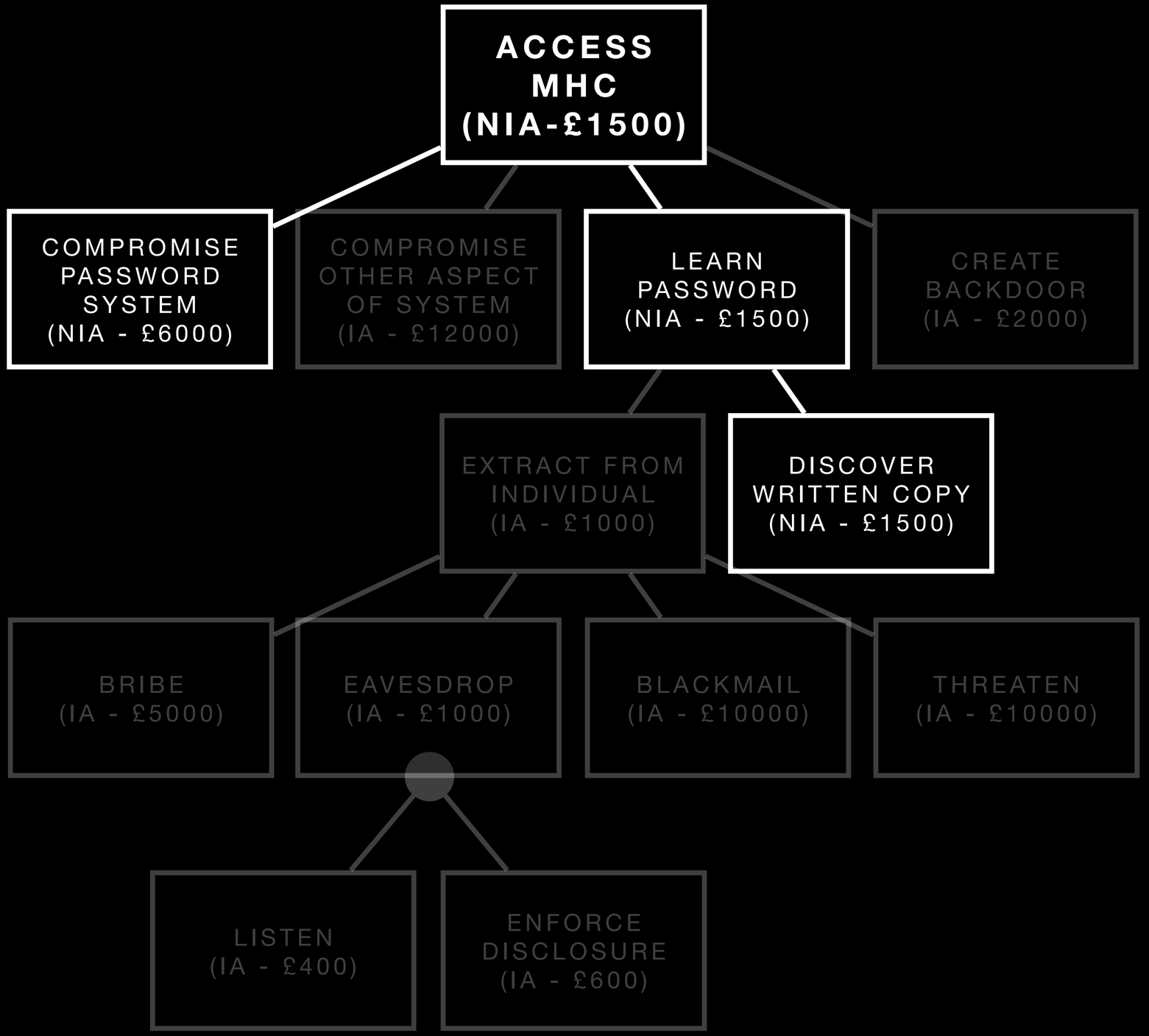
ENFORCE DISCLOSURE (I)


ACCESS MHC (NIA-£1500)
COMPROMISE PASSWORD SYSTEM (NIA - £6000)
COMPROMISE OTHER ASPECT OF SYSTEM (IA - £12000)
LEARN PASSWORD (NIA - £1500)
CREATE BACKDOOR (IA - £2000)
EXTRACT FROM INDIVIDUAL (IA - £1000)
DISCOVER WRITTEN COPY (NIA - £1500)
BRIBE (IA - £5000)
EAVESDROP (IA - £1000)
BLACKMAIL (IA - £10000)
THREATEN (IA - £10000)
LISTEN (IA - £400)
ENFORCE DISCLOSURE (IA - £600)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Attack Trees

Adversarial Behaviours

- Attack trees can be considered a **formal** approach of organising, discussing and finding threats to systems.
- Attack trees can be valuable in appreciating security **during an attack** and allow many different stakeholders to consider security.
- Attack trees can become complex and wide fast, making it difficult to consider large-scale attacks or campaigns.
- Attack trees are also often not complete, often considering known attacks and less optimal at unknown attacks.
- Pruning is important to ensure important attacks are considered.

Attack Trees

Adversarial Behaviours