A Survey of Connection-Chains Detection Techniques

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Outline

1. Introduction
2. Network-Based Approaches
3. Host-Based Approaches
4. System-Based Approaches
5. Summary

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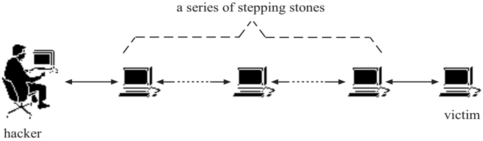
Connection Chains

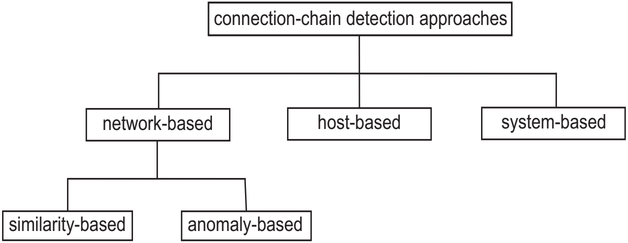


Connection chain

A set of tcp connections created by sequentially logging into a series of hosts, known as stepping-stones [Staniford-Chen 1995, Zhang 2000].

- Used to carry attacks indirectly.
- Avoid disclosing true origin of attack.
- Stay anonymous!

Taxonomy



- Taxonomy is based on the location of analysis.
- Network-Based: analyze packets at network level.
- Host-Based: operates inside a host.
- System-Based: use network-based and host-based components.

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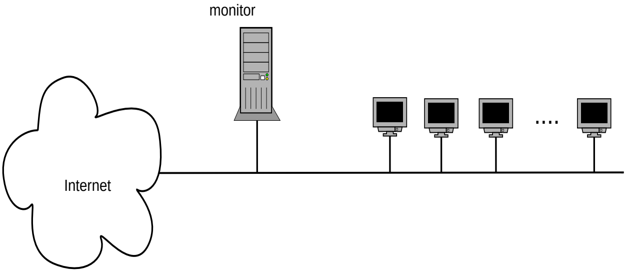
Overview

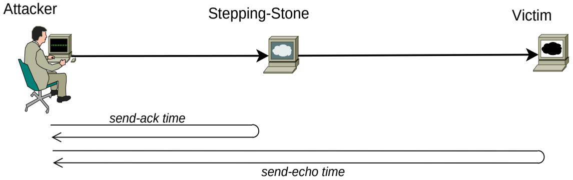


- Analyze packets/connections in a controlled network.
- Two types of network-based approaches:
    - Similarity-based: Find similarity between connections.
    - Anomaly-based: Analyze each connection alone.

Similarity-Based

- Apply similarity measures to compare the connections.
- Two types of similarity measures:
    - Content-based: analyze packets' contents (payloads).
        - Text Matching [Zhang and Paxon, 2000].
        - Compute character frequencies [Staniford-Chen and Heberlein, 1995].
    - Timing-based: analyze packets' timing.
        - Inter-packet delay [Wang et.al., 2002].
        - Typing pattern (On/Off) [Zhang and Paxon, 2000].

Anomaly-Based



[Yung, 2002]

- Compare send-ack time with send-echo time.
- send-echo time gets larger as the connection-chain gets longer.

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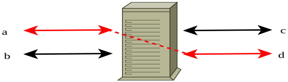
Host-Based Approaches



- Link two connections at a host (a and d in the figure).
- Two types of host-based approaches proposed:
  - Search processes [Carrier and Shields (2004)], [Kang et.al. (2004)].
  - Modify OS [Buchholz and Shields(2002)].

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System-Based Approaches

- Employ host-based and network-based components.

  Example: DIDS [Snapp et.al. 1991]
  - Monitors installed in every host.
  - A Director module receives data from the monitors for analysis.
  - Unique network user identifications (NID) used to track users.

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Summary

- A connection chain refers to the set of connections created by sequentially logging into a series of hosts.
- Attackers use them to stay anonymous.
- Detection approaches: Network-based, Host-base and System-based.