IT3789 Cyber Security Attack & Defence

L1 - Introduction to Penetration Testing

NANYANG POLYTECHNIC

WITH KNOWLEDGE COMES RESPONSIBILITY

Introduction to Penetration Testing

Enterprise Security Assessment

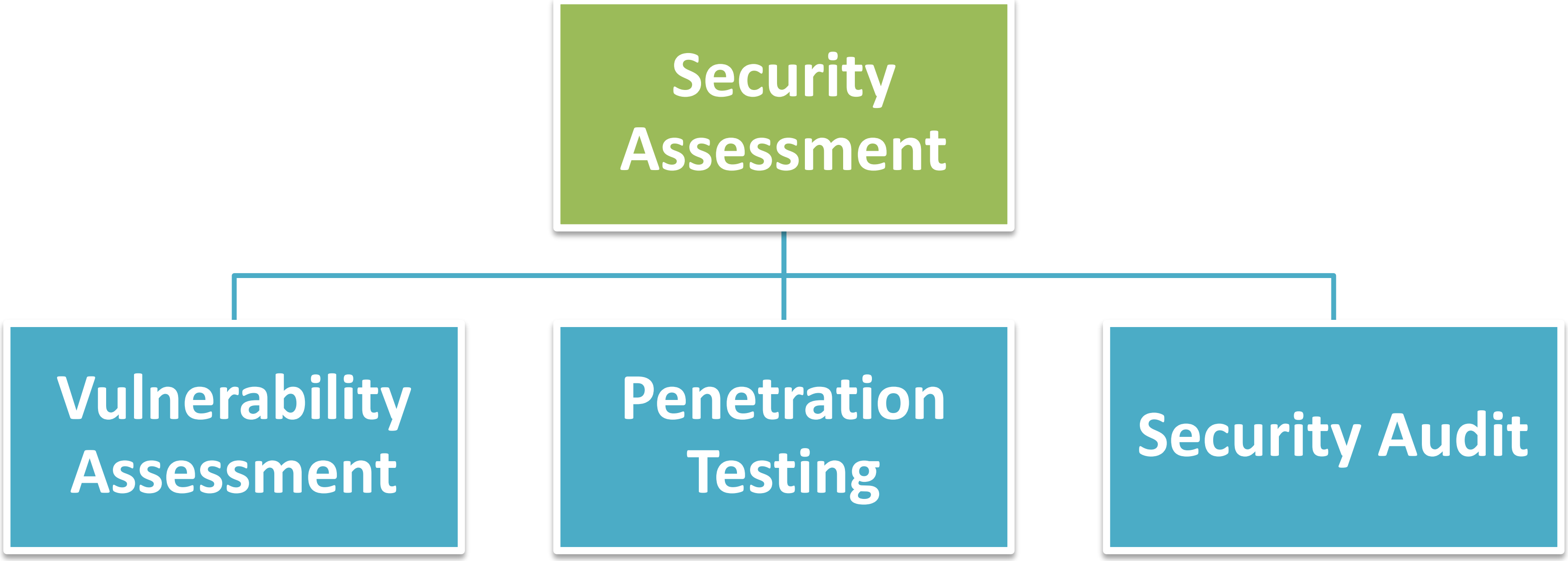
Penetration Testing

Code of Ethics

Enterprise Security Assessment

- Why?
  - – To assess an organization's security standards, processes and procedures.
  - – To discover vulnerabilities and risks that exist within an organization.
- Goal
  - – Ensure that necessary security controls are integrated into the systems within the organization.

Enterprise Security Assessment



Security Assessment

Vulnerability Assessment

Penetration Testing

Security Audit

Enterprise Security Assessment

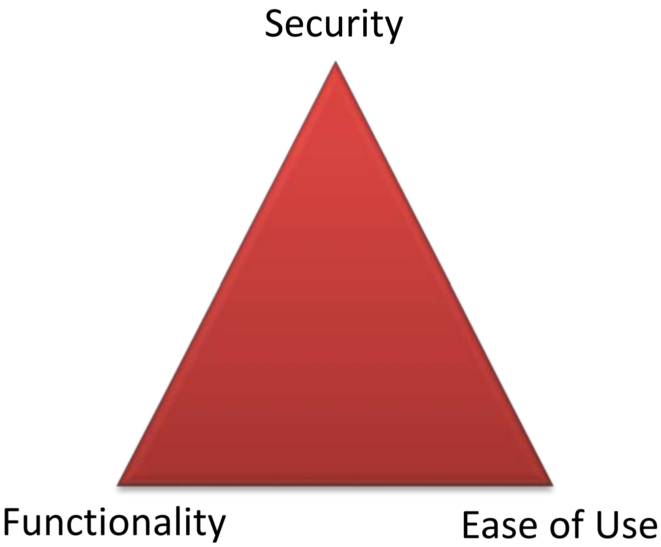
- Vulnerability Assessment
  - Focus on finding security vulnerabilities in systems.
  - Often does not involve exploitation of the discovered flaws.
  - Usually includes policy and procedure reviews.
- Penetration Testing
  - Focus on gaining access or obtaining information in target systems.

Enterprise Security Assessment

- Security Audit
  - Assess security risks faced by an organization.
  - Countermeasures against risks are tested against set of standards.
    - Example: ISO 27000 series (www.27000.org)
  - Reveals weaknesses in systems, practices and other key areas.

Security/Functionality/Ease of Use

- Increase and decrease in any one of the factors will impact the other 2 factors.
- Need to find a balance between the 3 factors.



Introduction to Penetration Testing

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Penetration Testing

- Purpose
  - See things from an attacker’s perspective.
  - Use hacking skills and toolsets for defensive purpose.
  - Test systems and network for weaknesses.
    - Help to find mistakes that other approaches miss.
    - Fewer in-depth interviews but more debriefings and scope check.
  - Propose countermeasures for any vulnerabilities identified.

Hackers

- Can be classified into 3 groups.
  - White Hats
    - Ethical hackers who use their skills for defensive purpose.
  - Black Hats
    - Malicious hackers or crackers who use their skills for illegal or malicious purpose.
  - Gray Hats
    - Hackers who may work offensively or defensively depending on the situation.
    - May just be interested in hacking tools and technologies.
    - Self-proclaimed ethical hackers.
      - Usually have no permission to perform penetration testing.

Terminologies

- Threat
  - Environment or situation that could lead a potential breach of security.
  - Example: Hackers with malicious intent.
- Vulnerability
  - A flaw in system that may lead to execution of damaging instructions.
- Exploit
  - A code that takes advantage of a vulnerability in a system
  - Leads to unauthorized access, privilege escalation and denial of service.

Terminologies

- Target of evaluation (TOE)
  - System, application or network that is subjected to security analysis or attack.
- Attack
  - Occurs when a system is compromised by exploiting a vulnerability.
- Remote
  - Exploit is sent over network.
  - No prior access to target system or network.
- Local
  - Exploit is directly executed on the system or network.
  - Requires prior access.

Penetration Test Types

- Various types of penetration testing can be performed.
- Each types simulate an attacker with different levels of knowledge about target organization.
- Penetration test types
  - White box testing
  - Black box testing
  - Gray box testing

Penetration Test Types

- Black Box Testing
  - No prior knowledge of the infrastructure or system to be tested.
  - Testers must determine the locations and system configurations.
  - Simulates a real malicious attacker.
  - More time spent on information gathering.

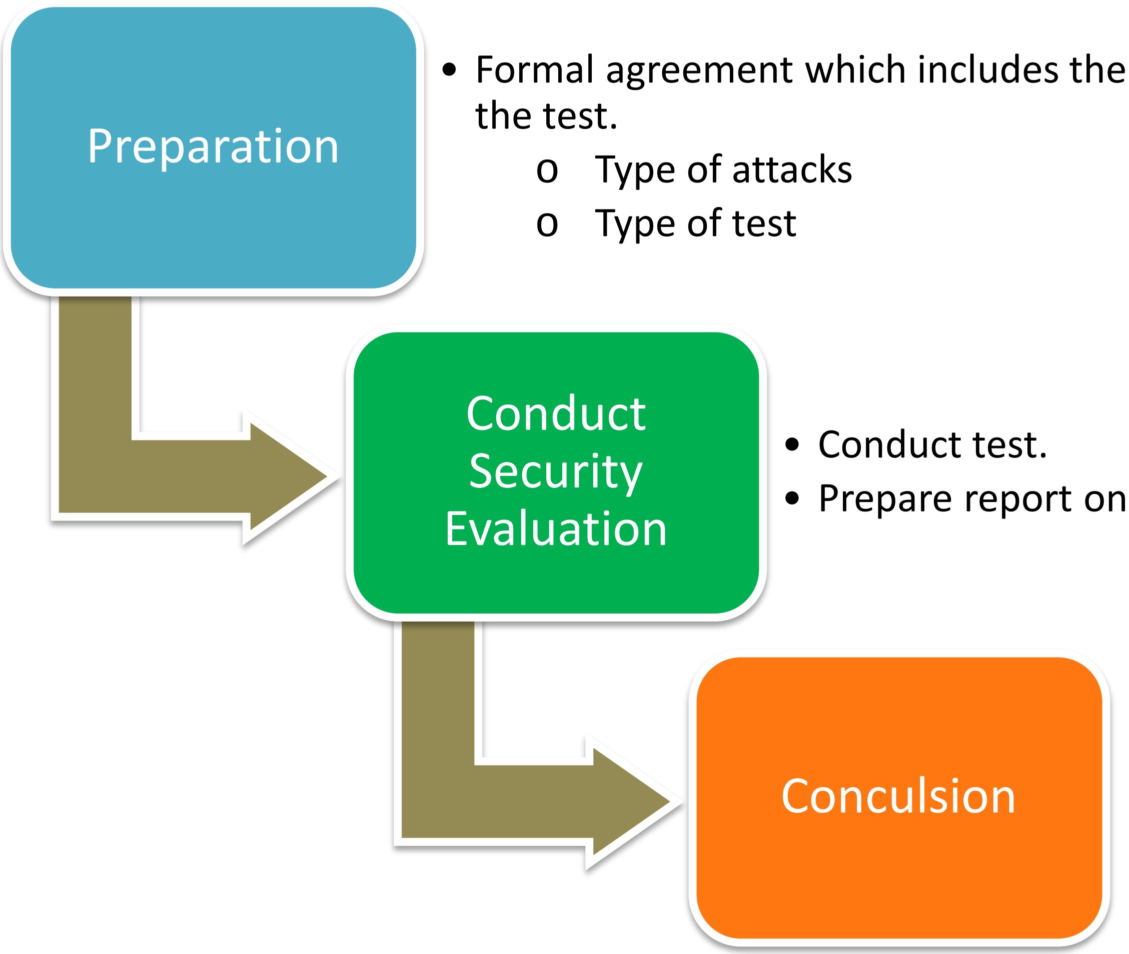
Penetration Test Types

- White Box Testing
  - Complete knowledge of network infrastructure.
  - Jumps right into the attack phase.
  - Avoid additional time and expense of black box testing.

Penetration Test Types

- Gray Box Testing
  - Perform a security evaluation and testing internally to examine the extent of access by insiders.
  - To simulate attacks that are initiated from within the network.
  - Test and audit level of access for employees and contractors.
    - Can privilege be escalated?

Performing Penetration Test



- Formal agreement which includes the full scope of the test.
    - Type of attacks
    - Type of test

- Conduct test.
- Prepare report on findings.

- Present findings.
- Recommend countermeasures.

Performing Penetration Test

- Penetration Tester **DOES NOT**…
  - fix or patch the vulnerabilities found.
  - Implement countermeasures.
- Deliverables of penetration testing.
  - Findings of test.
  - Analysis of associated risks.
  - Document findings by…
    - screenshots.
    - hacking tool output.
    - important log files.

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Keeping it Legal

- An penetration tester should know the penalties of unauthorized access into a system.
- Network penetration testing or security audit should not start till a signed legal document has been received.
- Consult lawyer.
- Need to find out the laws in various countries if penetration testing is performed across international borders.

Cyber Crime Laws in Singapore

- Computer Misuse and Cybersecurity Act (Chapter 50A)
  - Unauthorized access to computer material.
  - Access with intent to commit or facilitate commission of the offence.
  - Unauthorized modification of computer material.
  - Unauthorized use or interception of computer science.
  - Unauthorized obstruction of the use of computer.
  - Unauthorized disclosure of access code.
  - Enhanced punishment for offences involving protected computers.
  - Abetments and attempts punishable as offences.

Reference: http://statuts.agc.gov.sg

Getting Permission to Hack

- Gain authorization from client.
  - Signed contract for permission to perform test.
- Maintain and follow non-disclosure agreement (NDA) with client.
  - Maintain confidentiality when performing test.
  - No sensitive information gathered during test should be disclosed.
  - Information and results of the test should not be disclosed. Why?
- Perform the test up to the agreed-upon limits.

Company Obligations

- Ensure penetration tester is given just the necessary access to perform the test.
- Place safeguards to protect organization.
  - Network and system monitoring and logging targeted at penetration tester.
  - Escort the tester while on organization property.
  - Restrict data from leaving organization.
    - Usually in sensitive environments (e.g. military).
    - Documentations and equipment are not allow to enter or leave the organization.
    - If equipment are allowed, then they must be sanitized before leaving.

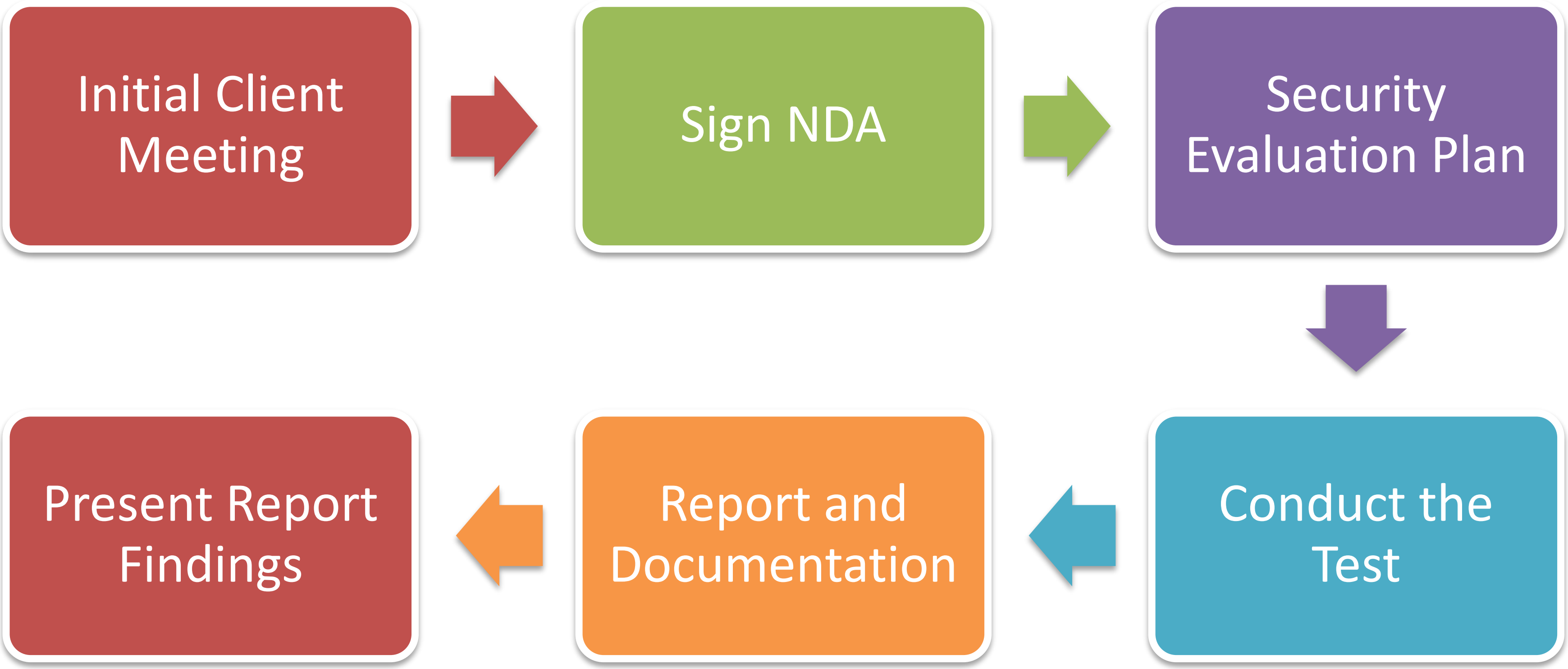
Contractor Obligations

- There should be a clause to indicate how can penetration tester use the information gathered.
  - Tester will only disclose information to employees with a “need to know”.
- Delivery and destruction of data.
  - Test must be completed within agreed time frame.
  - Present client with certificate of destruction.
    - Certificate contains detailed list
      - Information disposed.
      - Date of destruction.
      - Who authorized the destruction?
      - Who witness the destruction?
  - Method of destruction.
    - Maybe dictated by client.

Auditing & Monitoring

- Client audits tester’s systems to ensure that the tester is compliant with the contract.
  - How are data managed, store and transferred?
- Monitoring is done so that client feels confident that the tester is only performing tests that is stated in the contract.
  - If tester realized that there is a need to step outside contracted boundaries, he has to stop all activities and negotiates agreement.
    - A new contract may be required.

Security Audit Steps



Initial Client Meeting

Sign NDA

Security Evaluation Plan

Conduct the Test

Report and Documentation

Present Report Findings

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- Why?
- Goal
- Security Assessment

Penetration Testing

- Penetration Test Types
- Performing Penetration Testing

Code of Ethics

- Cyber Crime Laws in Singapore
- Getting Permission to Hack