Introduction to Ethical Hacking

Module 1

Engineered by Hackers. Presented by Professionals.

SECURITY NEWS

December 06, 2010 1:33 AM GMT

Bloomberg NEWS

China's `Patriotic Hackers' Attack U.S. Sites Including Google, NYT Says

"Patriotic hackers" backed by Chinese authorities conducted extensive computer hacking on U.S. government agencies and companies, including computer networks of Google Inc., according to a report published by the New York Times.

An examination of 250,000 diplomatic cables made public by WikiLeaks.org by the U.S. newspaper showed that high-level Chinese civilian and military officials assisted successful hacking attacks aimed at retrieving a wide range of U.S. government and military information.

At least one previously unreported attack conducted by Chinese hackers linked to the People's Liberation Army in 2008 yielded more than 50 megabytes of e-mails, user names, and passwords from a U.S. government agency, the Times said.

http://www.bloomberg.com

Security News

December 20, 2010

Playing defense on the Net

On Nov. 30, only days before Internet activists shut down the websites of credit card companies Visa and MasterCard, five major online retailers faced a similar attack, timed to coincide with the start of the holiday shopping season.

The attacks against Visa and MasterCard paralyzed their company websites for hours. But even though the assault on the retail sites used similar methods, they didn't have the same effect. The floods of illicit data were intercepted by a global network run by Akamai Technologies Inc.

Akamai is a Cambridge Internet infrastructure company, delivering massive amounts of online data for major businesses and government agencies. It is also one of many companies that defend the Internet from distributed denial of service, or DDOS, attacks, old but potent digital weapons wielded by criminals, protestors, and vandals around the world.

What was unusual about the recent attacks was that the public heard about them. Similar online data blitzes happen constantly, but they hardly ever do real damage, and even when they do, the effects are usually fleeting.

"The capabilities to stop them have significantly evolved over the last decade," said Craig Labovitz, chief scientist at Arbor Networks Inc., a Chelmsford company that specializes in quashing DDOS attacks.

http://www.boston.com

Case Study

Website for Tour company CitySights NY hit by hackers

Hackers have broken into the website of the New York tour company CitySights NY and stolen about **110,000 bank card numbers**.

They broke in using a **SQL Injection attack** on the company's Web server, CitySights NY said in a Dec. 9 breach notification letter published by New Hampshire's attorney general. The company learned of the problem in late October, when, "a web programmer **discovered [an] unauthorized script** that appears to have been uploaded to the company's web server, which is believed to have compromised the security of the database on that server," the letter said.

CitySights NY believes that the SQL injection compromise occurred about a month earlier, on Sept. 26. In a SQL injection attack, hackers find ways to **sneak real database commands into the server using the Web**. They do this by adding specially crafted text into Web-based forms or search boxes that are used to query the back-end database.

This was one of the techniques used by Albert Gonzalez, who in March received the longest-ever U.S. federal sentence related to hacking the systems of Heartland Payment Systems, TJX and other companies.

In the CitySights NY incident, hackers were able to get **names**, **addresses**, **e-mail addresses**, **credit card numbers** and their expiration dates, and Card Verification Value 2 codes, used to validate online credit card purchases.

http://www.networkworld.com

Module Objectives

- Elements of Information Security
- The Security, Functionality, and Usability Triangle
- Security Challenges
- Effects of Hacking
- Who is a Hacker?
- Hacker Classes
- Types of Hackers
- Hacking Phases
- Types of Attacks on a System
- Why Ethical Hacking is Necessary?
- Scope and Limitations of Ethical Hacking
- What Do Ethical Hackers Do?
- Skills of an Ethical Hacker
- Vulnerability Research



Scenario: How Simple Things Can Get You into Trouble?

Gwen was working late. She could not complete her task so she spoke to her boss and took work home in a USB device. She worked the entire night and brought the work back to the office.

A few days later, someone else used the device who was not aware of the data Gwen had put on it. He misplaced the device and never found it again, but started using another USB device in the place of the old one.

Shortly after that, the company recevied a call from a client saying that details of their project were found online.

What went wrong? Who was responsible for this?


Module Flow
Info Security Overview
Hacking Concepts
Hacking Phases
Types of Attacks
Ethical Hacking
Vulnerability Research
C|EH
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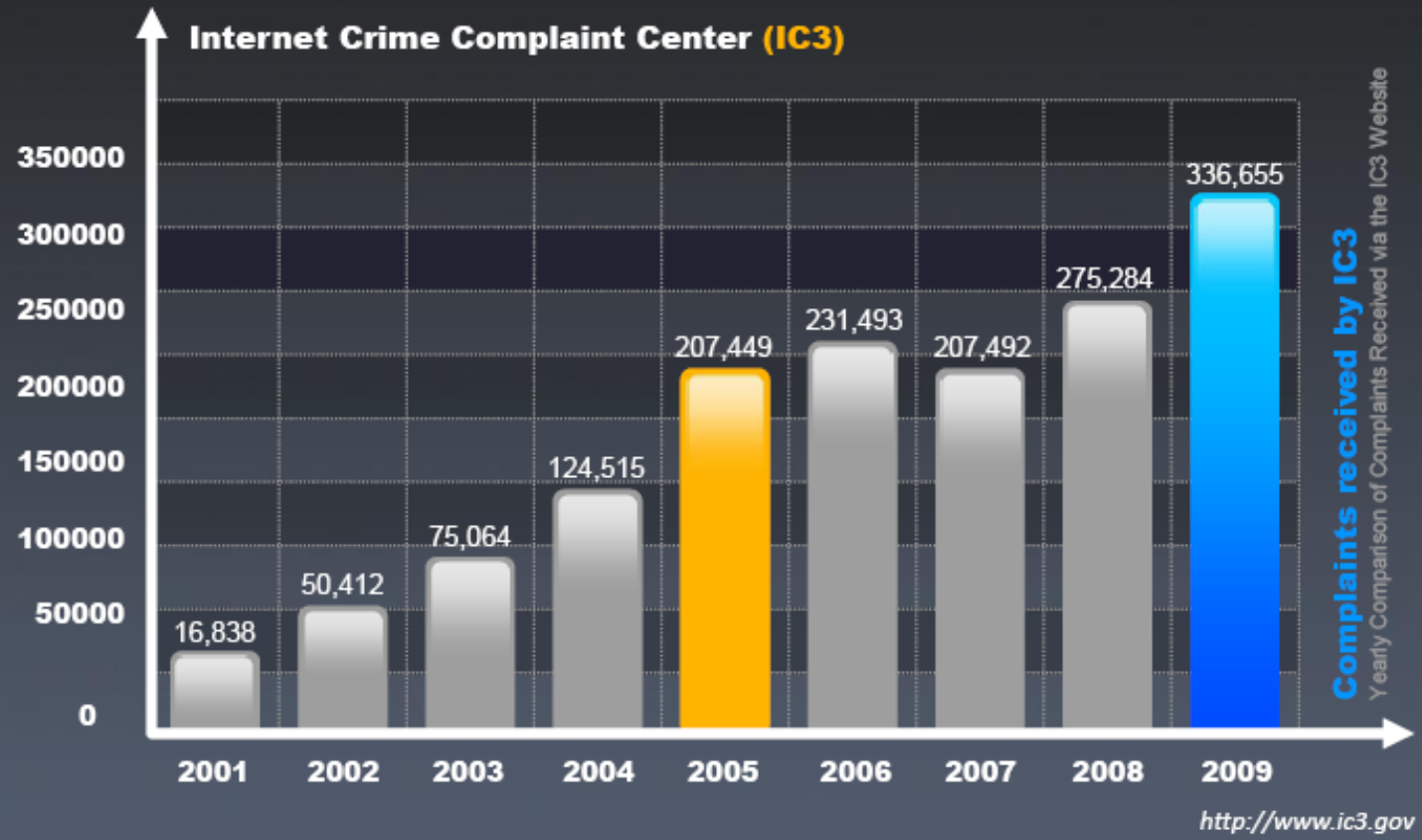
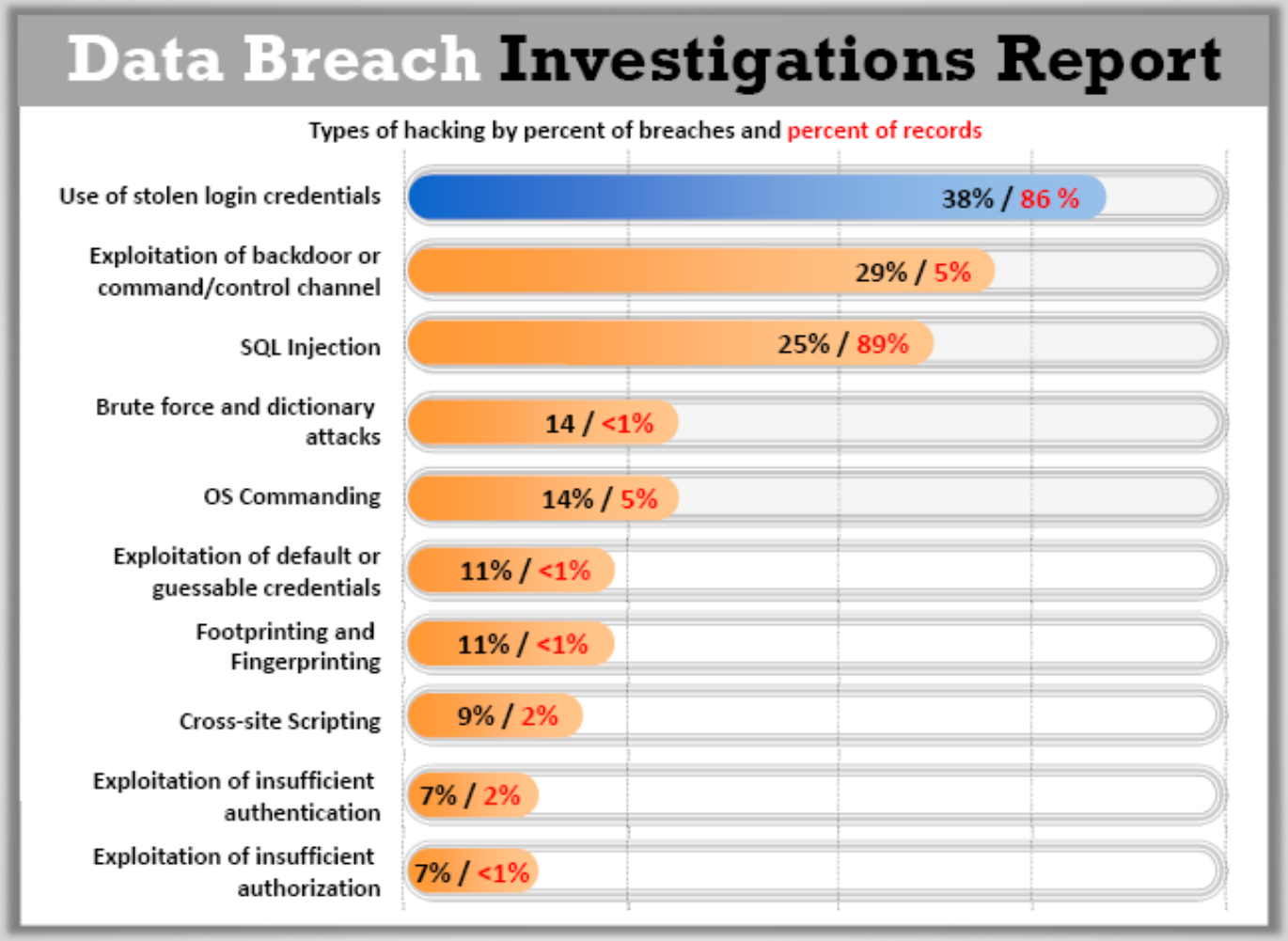
Internet Crime Current Report: IC3

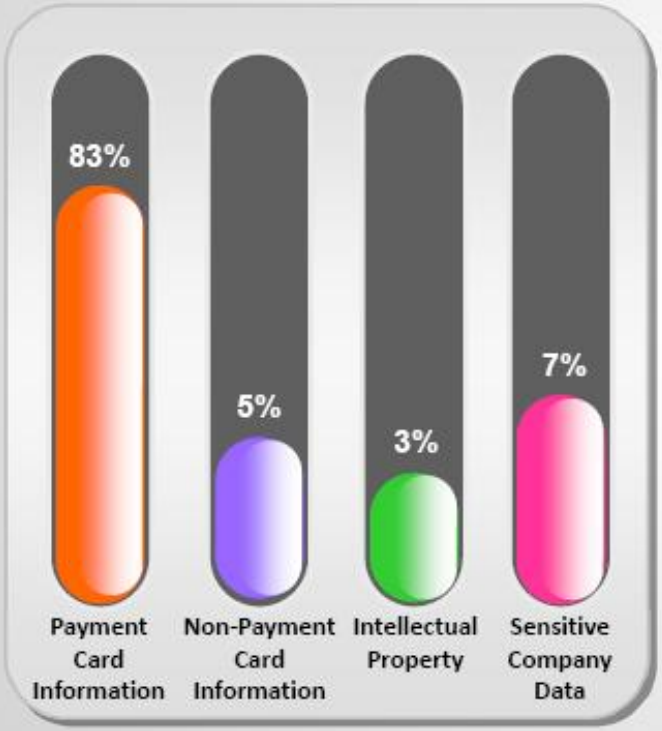


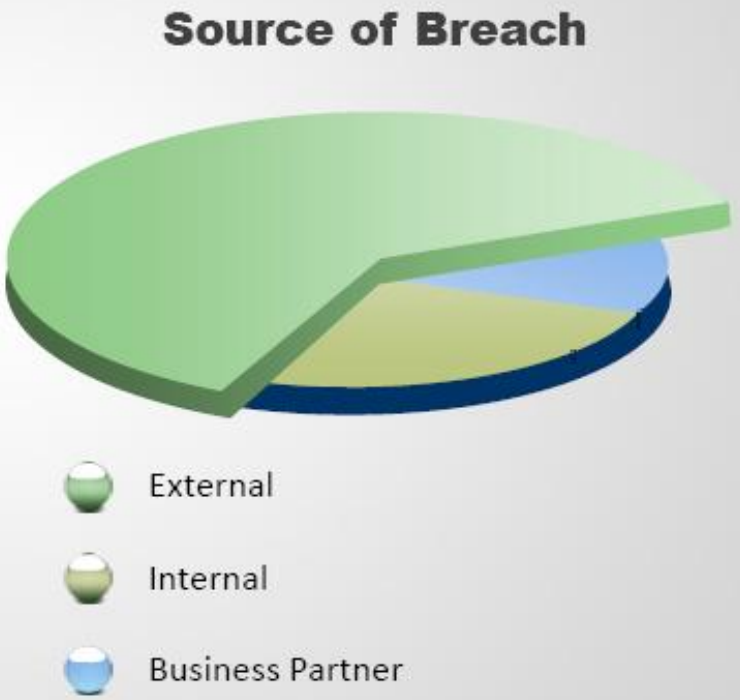
Data Breach Investigations Report



http://www.verizonbusiness.com

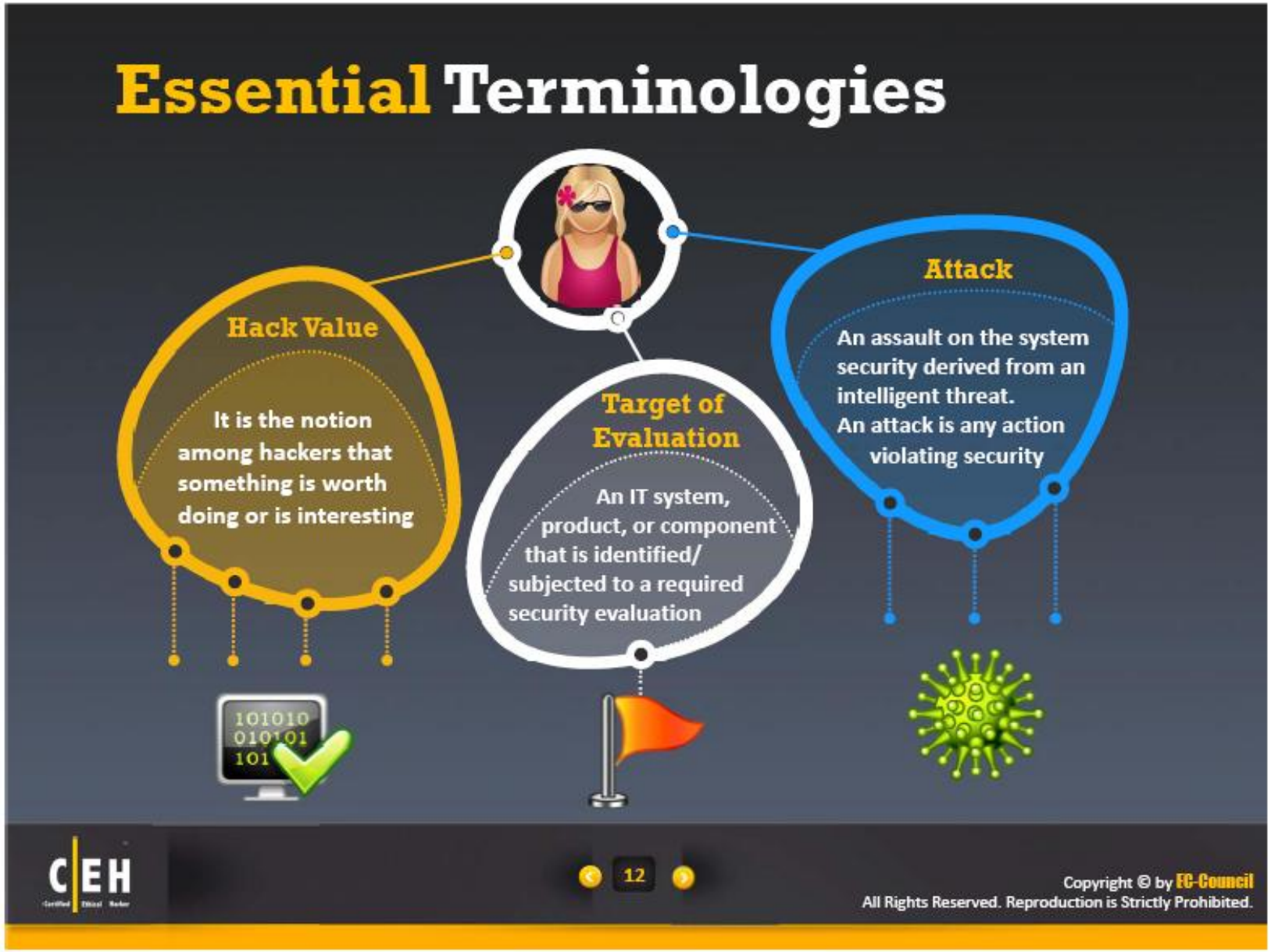
Types of Data Stolen From the Organizations





UK Security Breach Investigations Report 2010, Source: *http://www.7safe.com*

Essential Terminologies



Essential Terminologies

Exploit

A defined way to **breach the security** of an IT system through vulnerability

A Zero-Day

A computer threat that tries to **exploit computer application vulnerabilities** that are unknown to others or undisclosed to the software developer

Security

A state of well-being of information and infrastructure in which the possibility of **theft**, **tampering**, and **disruption of information and services** is kept low or tolerable

Essential Terminologies

Threat

An action or event that might compromise security

A threat is a potential violation of security

Vulnerability

Existence of a weakness, design, or implementation error that can lead to an unexpected and undesirable event compromising the security of the system

Daisy Chaining

Hackers who get away with database theft usually complete their task, then backtrack to cover their tracks by destroying logs, etc.

Elements of Information Security

C
Confidentiality

Assurance that the information is accessible only to those authorized to have access

Confidentiality breaches may occur due to improper data handling or a hacking attempt

I
Integrity

The trustworthiness of data or resources in terms of preventing improper and unauthorized changes

Assurance that information can be relied upon to be sufficiently accurate for its purpose

A
Availability

Assurance that the systems responsible for delivering, storing, and processing information are accessible when required by the authorized users

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Authenticity and Non-Repudiation

Authenticity

- Authenticity refers to the characteristic of a communication, document or any data that ensures the quality of being genuine or not corrupted from the original
- Major roles of authentication include confirming that the user is who he or she claims to be and ensuring the message is authentic and not altered or forged
- Biometrics, smart cards, or digital certificates are used to ensure authenticity of data, transactions, communications or documents

Non-Repudiation

- It refers to the ability to ensure that a party to a contract or a communication cannot deny the authenticity of their signature on a document or the sending of a message that they originated
- It is a way to guarantee that the sender of a message cannot later deny having sent the message and that the recipient cannot deny having received the message
- Digital signatures and encryption are used to establish authenticity and non-repudiation of a document or message

The Security, Functionality, and Usability Triangle

- Level of security in any system can be defined by the strength of three components:


Security Challenges
Compliance to government laws and regulations
Evolution of technology focused on ease of use
Direct impact of security breach on corporate asset base and goodwill
Increased number of network-based applications
It is difficult to centralize security in a distributed computing environment
Increasing complexity of computer infrastructure administration and management
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Security Challenges

Top Security Challenges

1. Increase in sophisticated cyber criminals
2. Data leakage, malicious insiders, and remote workers
3. Mobile security, adaptive authentication, and social media strategies
4. Cyber security workforce
5. Exploited vulnerabilities, operationalizing security
6. Critical infrastructure protection
7. Balancing sharing with privacy requirements
8. Identity access strategies and lifecycle

List of Security Risks

1. Trojans/Info Stealing Keyloggers/
2. Fast Flux Botnets
3. Data Loss/Breaches
4. Internal Threats
5. Organized Cyber Crime
6. Phishing/Social Engineering
7. New emerging viruses
8. Cyber Espionage
9. Zero-Day Exploits
10. Web 2.0 Threats
11. Vishing attacks

List of Security Risks

12. Identity black market
13. Cyber-extortion
14. Transportable data (USB, laptops, backup tapes)
15. "Zombie" networks
16. Exploits in new technology
17. Outsourcing projects
18. Social networking
19. Business interruption
20. Virtualization and cloud Computing


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Effects of Hacking

Effects of Hacking on Business

According to the Symantec 2010 State of Enterprise Security Study, hacking attacks cost large businesses an average of about $2.2 million per year

Theft of customers' personal information may risk the business's reputation and invite lawsuits

Hacking can be used to steal, pilferage, and redistribute intellectual property leading to business loss

Botnets can be used to launch various types of DoS and other web-based attacks which may lead to business down-time and significant loss of revenues

Attackers may steal corporate secrets and sell them to competitors, compromise critical financial information, and leak to the rivals

Who is a Hacker?

Intelligent individuals with excellent computer skills, with the ability to create and explore into the computer's software and hardware

For some hackers, hacking is a hobby to see how many computers or networks they can compromise

Their intention can either be to gain knowledge or to poke around to do illegal things

Some do hacking with malicious intent behind their escapades, like stealing business data, credit card information, social security numbers, email passwords, etc.

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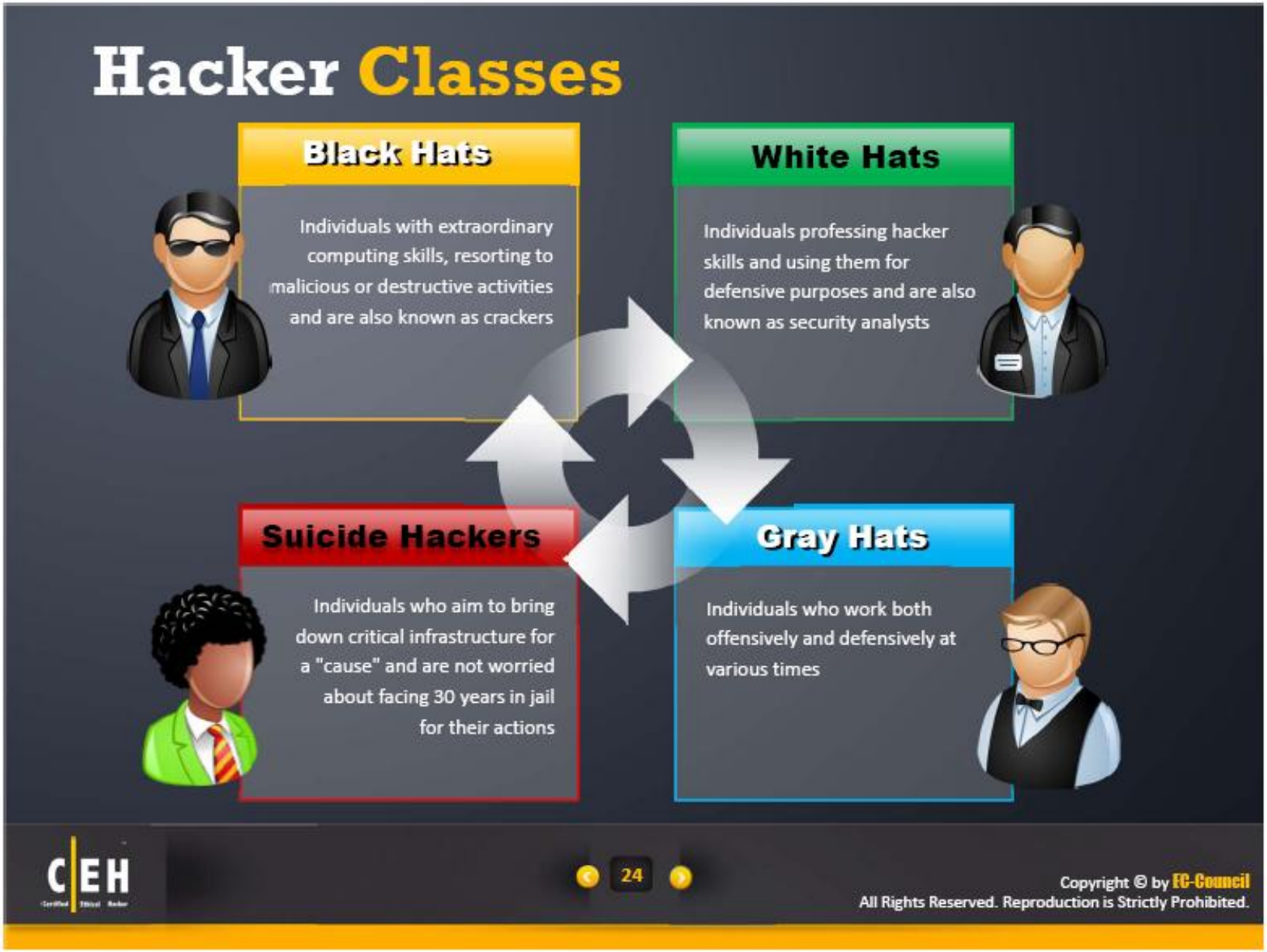

Hacktivism

Hacktivism is an act of promoting a political agenda by hacking, especially by defacing or disabling websites

It thrives in the environment where information is easily accessible

Aims at sending a message through their hacking activities and gaining visibility for their cause

Common targets include government agencies, multinational corporations, or any other entity perceived as bad or wrong by these groups or individuals

It remains a fact, however, that gaining unauthorized access is a crime, *no matter what the intention is*


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What Does a Hacker Do?

Phase 1 - Reconnaissance

Reconnaissance refers to the preparatory phase where an attacker seeks to gather information about a target prior to launching an attack

1

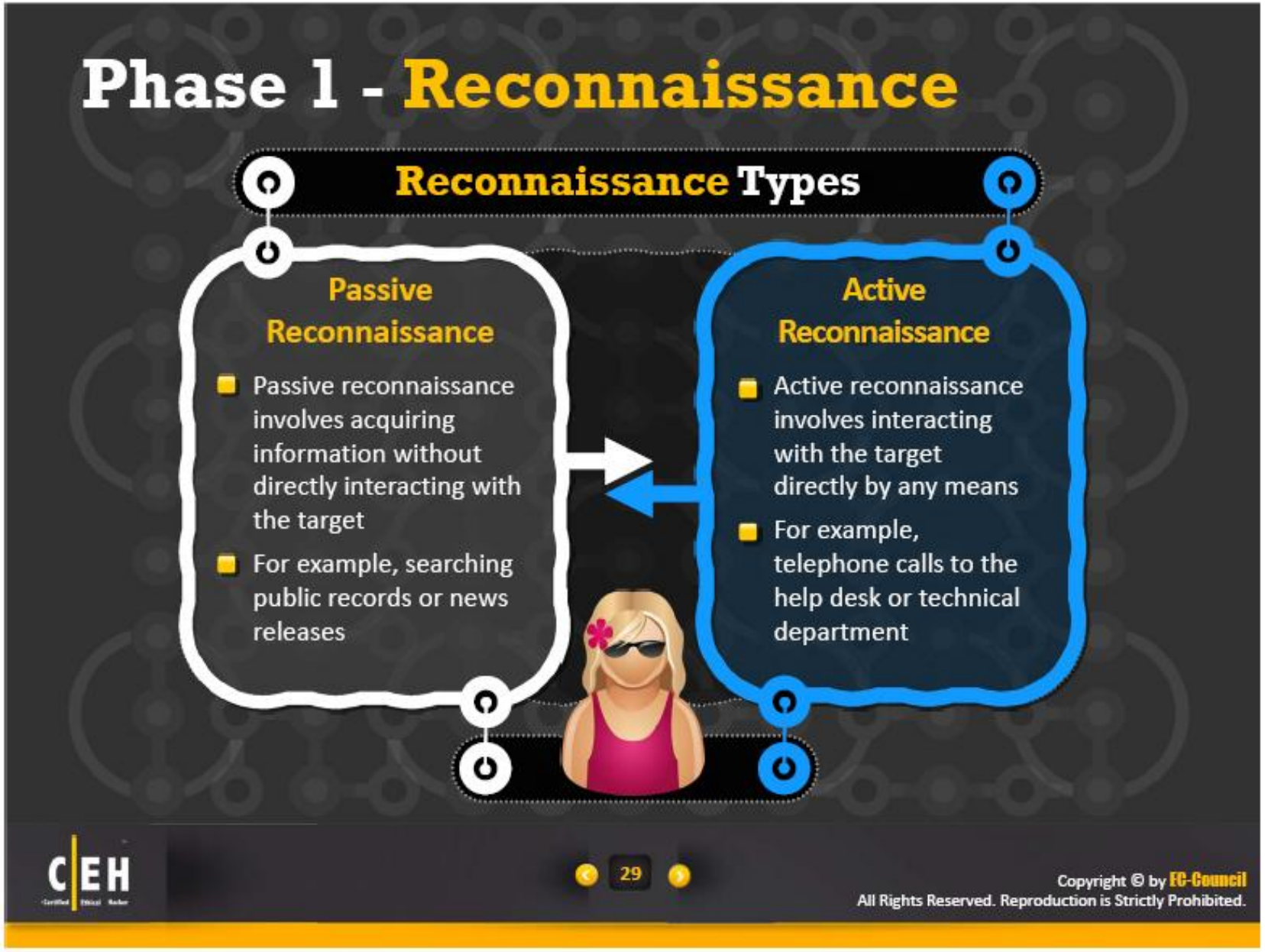
Could be the future point of return, noted for ease of entry for an attack when more about the target is known on a broad scale

2

Reconnaissance target range may include the target organization's clients, employees, operations, network, and systems

3

Phase 1 - Reconnaissance



Phase 2 - Scanning

Pre-Attack Phase

Scanning refers to the pre-attack phase when the attacker scans the network for specific information on the basis of information gathered during reconnaissance

Port Scanner

Scanning can include use of dialers, port scanners, network mapping, sweeping, vulnerability scanners, etc.

Extract Information

Attackers extract information such as computer names, IP address, and user accounts to launch attack

Phase 3 – Gaining Access

Gaining access refers to the point where the attacker obtains access to the operating system or applications on the computer or network

The attacker can escalate privileges to obtain complete control of the system. In the process, intermediate systems that are connected to it are also compromised

The attacker can gain access at the operating system level, application level, or network level

Examples include password cracking, buffer overflows, denial of service, session hijacking, etc.

Phase 4 – Maintaining Access

Maintaining access refers to the phase when the attacker tries to retain his or her ownership of the system

Attackers may prevent the system from being owned by other attackers by securing their exclusive access with Backdoors, RootKits, or Trojans

Attackers use the compromised system to launch further attacks

Attackers can upload, download, or manipulate data, applications, and configurations on the owned system

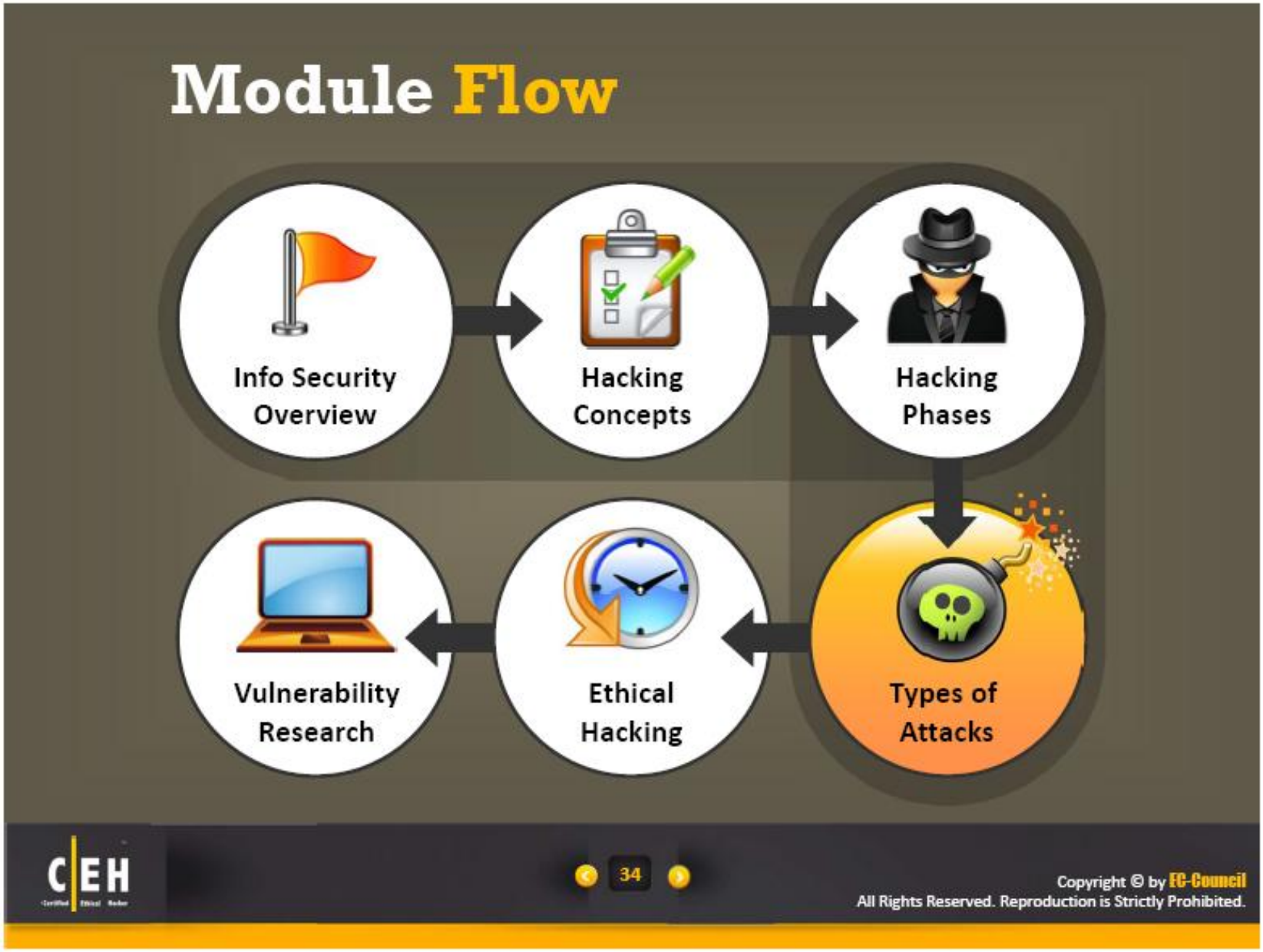
Phase 5 – Covering Tracks

Covering tracks refers to the activities carried out by an attacker to hide malicious acts

The attacker's intentions include: Continuing access to the victim's system, remaining unnoticed and uncaught, deleting evidence that might lead to his prosecution

The attacker overwrites the server, system, and application logs to avoid suspicion

Attackers always cover tracks to hide their identity



Types of Attacks on a System

- There are several ways an attacker can gain access to a system
- The attacker must be able to exploit a weakness or vulnerability in a system

Operating system attacks

Mis-configuration attacks

Application level attacks

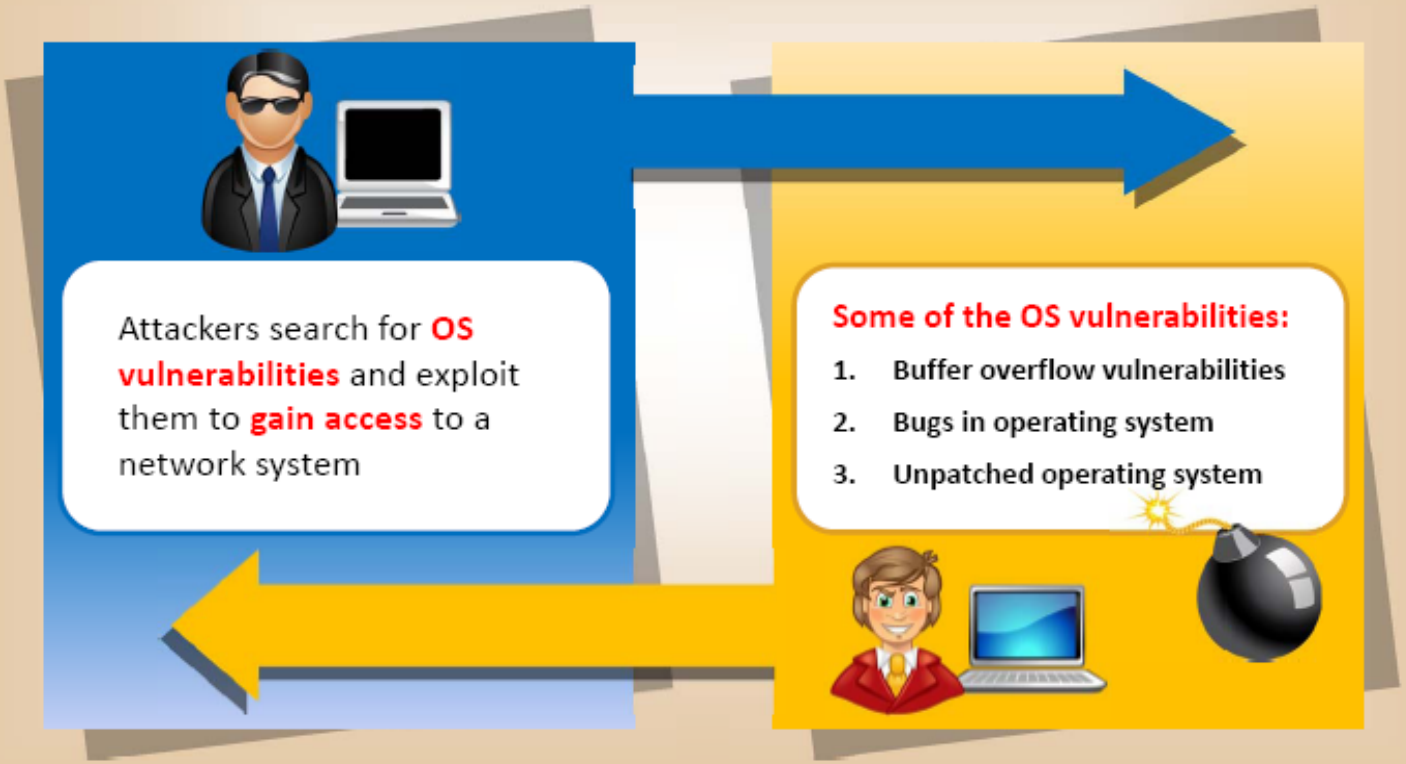
Shrink wrap code attacks

Types of Attacks on a System

Eavesdropping	Data Modification Attacks	Man-in-the-Middle Attacks
Identity Spoofing	Repudiation Attacks	Back door Attacks
Snooping Attacks	DoS Attacks	Spoofing Attacks
Interception	DDoS Attacks	Compromised-Key Attacks
Replay Attacks	Password Guessing Attacks	Application-Layer Attacks

Attacks on a System

Operating System Attacks



Application-Level Attacks

- Software applications come with tons of functionalities and features
- There is a dearth of time to **perform complete testing** before releasing products

Poor or nonexistent error checking in applications leads to:

- Buffer overflow attacks
- Active content
- Cross-site scripting
- Denial of service and SYN attacks
- SQL injection attacks
- Malicious bots

Other application-level attacks include:

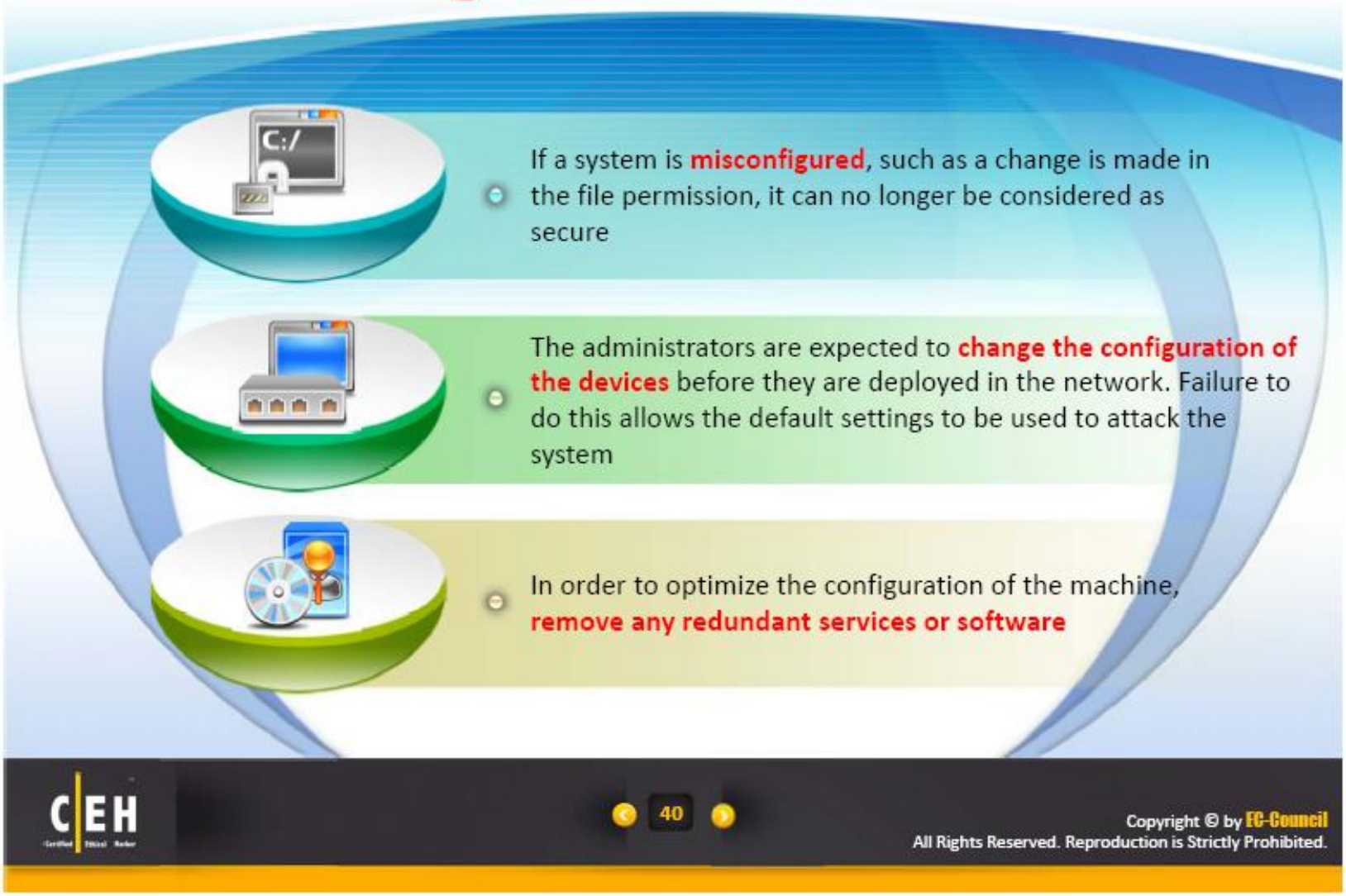
- Phishing
- Session hijacking
- Man-in-the-middle attack
- Parameter/Form Tampering
- Directory traversal attacks

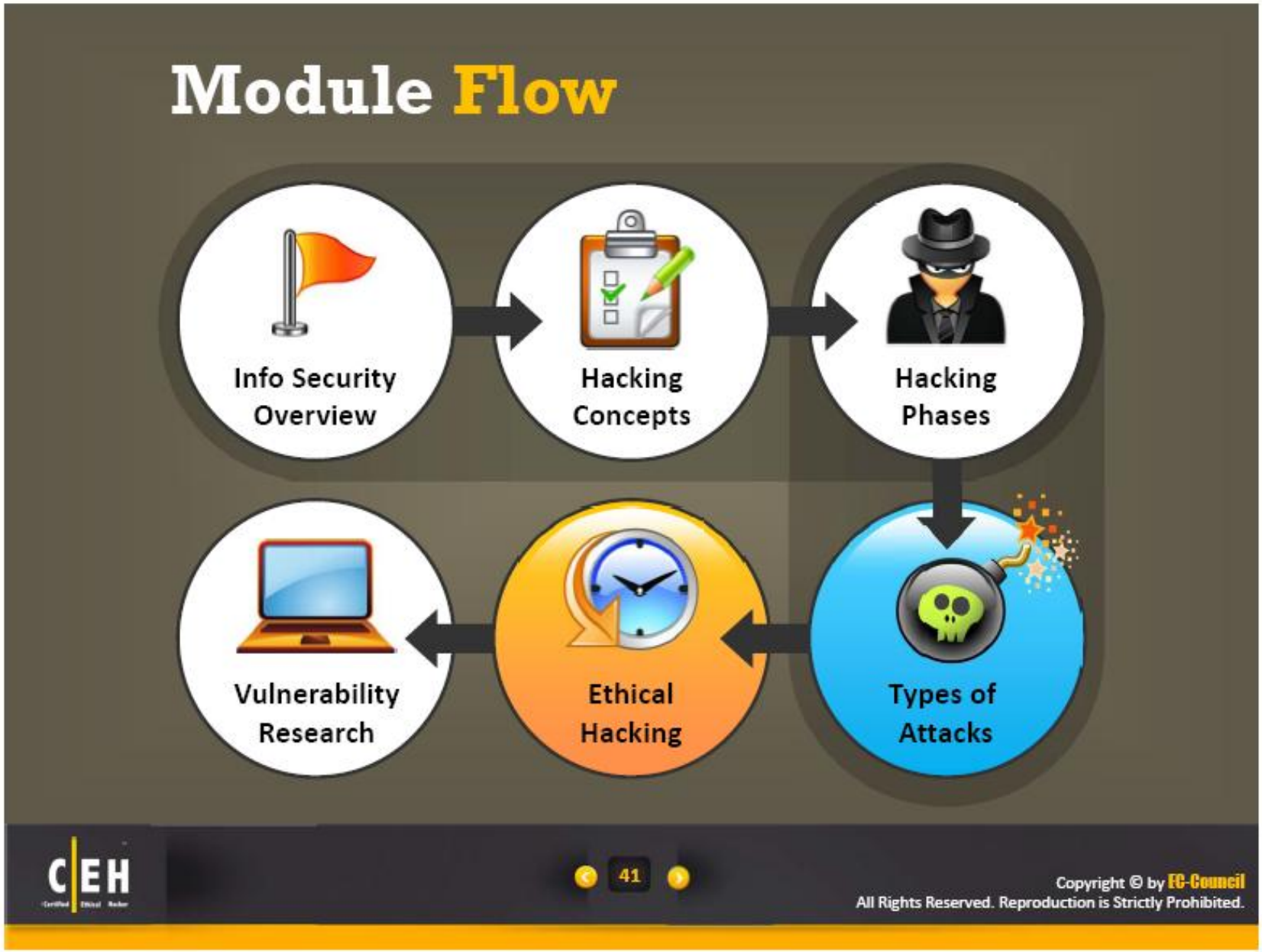
Shrink Wrap Code Attacks

- Why reinvent the wheel when you can buy off-the-shelf "**libraries**" and code?
- When you install an OS/Application, it comes with tons of sample scripts to make the life of an administrator easy
- The problem is "**not fine tuning**" or customizing these scripts
- This will lead to default code or shrink wrap code attacks

```
Private Function CleanUpLine(ByVal sLine As String) As String
    Dim lQuoteCount As Long
    Dim lcount      As Long
    Dim sChar       As String
    Dim sPrevChar   As String

    ' Starts with Rem it is a comment
    sLine = Trim(sLine)
    If Left(sLine, 3) = "Rem" Then
        CleanUpLine = ""
        Exit Function
    End If

    ' Starts with ' it is a comment
    If Left(sLine, 1) = "'" Then
        CleanUpLine = ""
        Exit Function
    End If

    ' Contains ' may end in a comment, so test if it is a comment or in the
    ' body of a string
    If InStr(sLine, "'") > 0 Then
        sPrevChar = " "
        lQuoteCount = 0

        For lcount = 1 To Len(sLine)
            sChar = Mid(sLine, lcount, 1)

            ' If we found " ' " then an even number of " characters in front
            ' means it is the start of a comment, and odd number means it is
            ' part of a string
            If sChar = "'" And sPrevChar = " " Then
                If lQuoteCount Mod 2 = 0 Then
                    sLine = Trim(Left(sLine, lcount - 1))
                    Exit For
                End If
            ElseIf sChar = """" Then
                lQuoteCount = lQuoteCount + 1
            End If
            sPrevChar = sChar
        Next lcount
    End If

    CleanUpLine = sLine
End Function
```

Misconfiguration Attacks





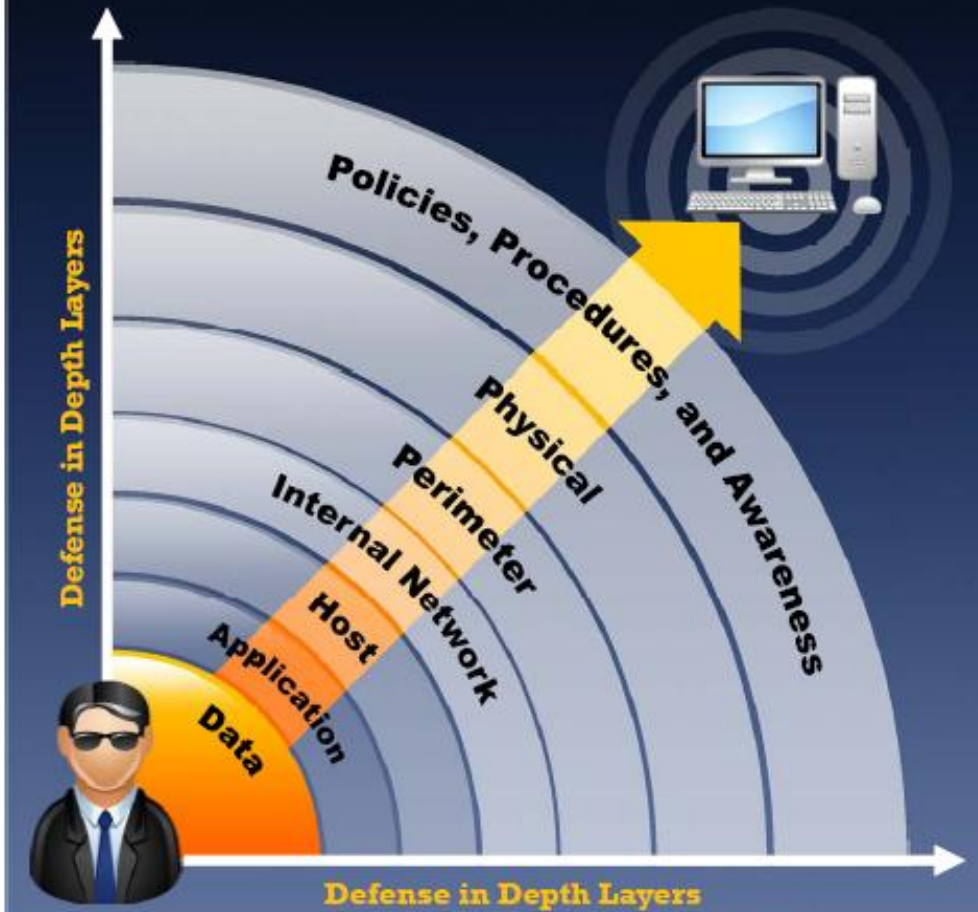
Why Ethical Hacking is Necessary?

As hacking involves creative thinking, **vulnerability testing** and **security audits** cannot ensure that the network is secure

To achieve this, organizations need to implement a "**defense in depth**" strategy by penetrating into their networks to estimate vulnerabilities and expose them

Ethical hacking is necessary because it allows the countering of attacks from malicious hackers by **anticipating methods** they can use to **break into a system**

Defense in Depth



- Defense in depth is a security strategy in which several protection layers are placed throughout an information system
- It helps to prevent direct attacks against an information system and data because a break in one layer only leads the attacker to the next layer

Scope and Limitations of Ethical Hacking

Scope

Ethical hacking is a crucial component of **risk assessment, auditing**, **counterfraud**, **best practices**, and **good governance**

Scope

It is used to **identify risks** and highlight the **remedial actions**, and also reduces information and communications technology (ICT) costs by resolving those vulnerabilities

Limitations

However, unless the businesses first know what it is at that they are looking for and why they are **hiring an outside vendor to hack systems** in the first place, chances are there would not be much to gain from the experience

Limitations

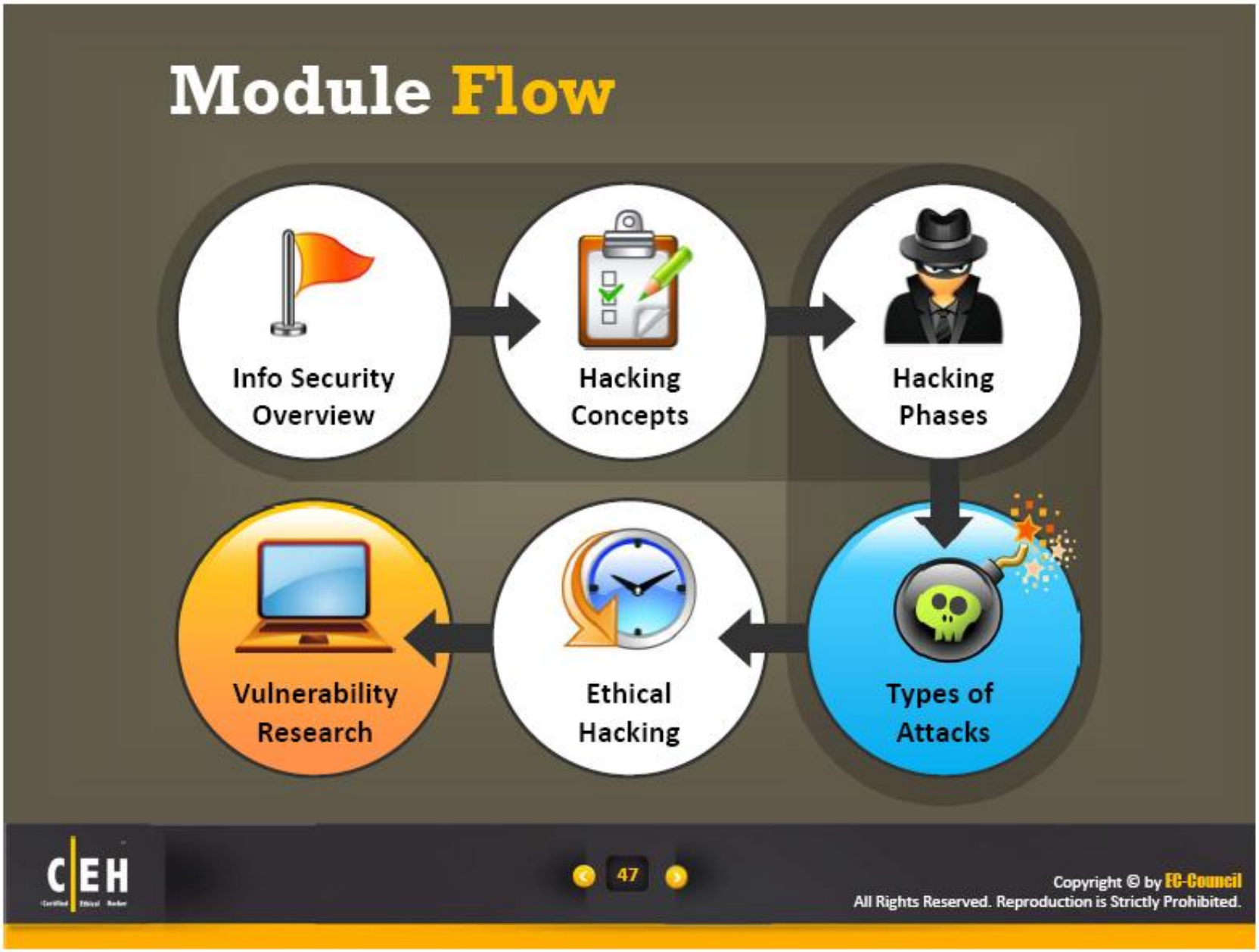
An ethical hacker thus can only help the organization to better **understand their security system**, but it is up to the organization to **place the right guards** on the network

What Do Ethical Hackers Do?

Ethical hackers try to answer the following questions:

What can the intruder see on the target system? (Reconnaissance and Scanning phases)	What can an intruder do with that information? (Gaining Access and Maintaining Access phases)	Does anyone at the target notice the intruders' attempts or successes? (Reconnaissance and Covering Tracks phases)

- Ethical hackers are hired by organizations to attack their information systems and networks in order to **discover vulnerabilities** and **verify that security measures** are functioning correctly
- Their duties may include **testing systems and networks for vulnerabilities** and attempting to access sensitive data by breaking security controls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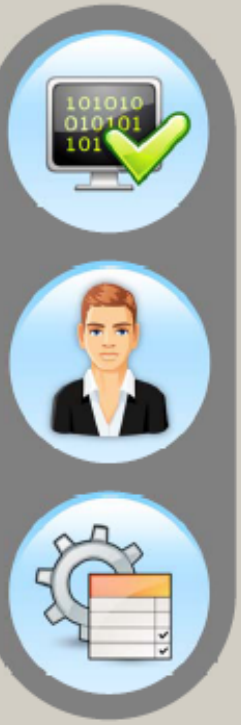
Vulnerability Research

- The process of discovering vulnerabilities and design flaws that will open an operating system and its applications to attack or misuse
- Vulnerabilities are classified based on severity level (low, medium, or high) and exploit range (local or remote)

An administrator needs vulnerability research:

- To identify and correct the network vulnerabilities
- To gather information about viruses
- To find weaknesses and alert the network administrator before a network attack
- To protect the network from being attacked by intruders
- To get information that helps to prevent the security problems
- To know how to recover from a network attack

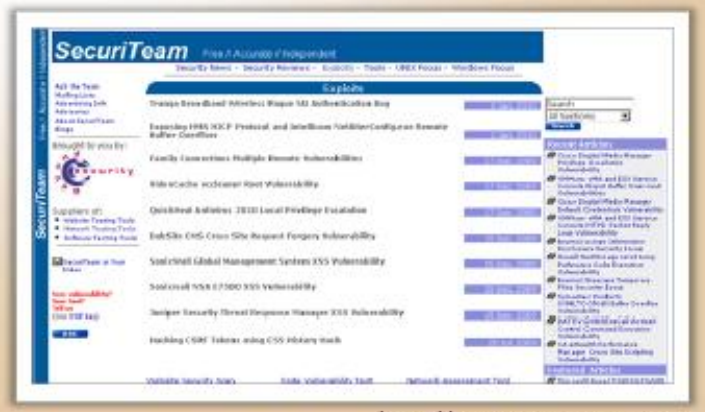


Vulnerability Research Websites

http://www.kb.cert.org

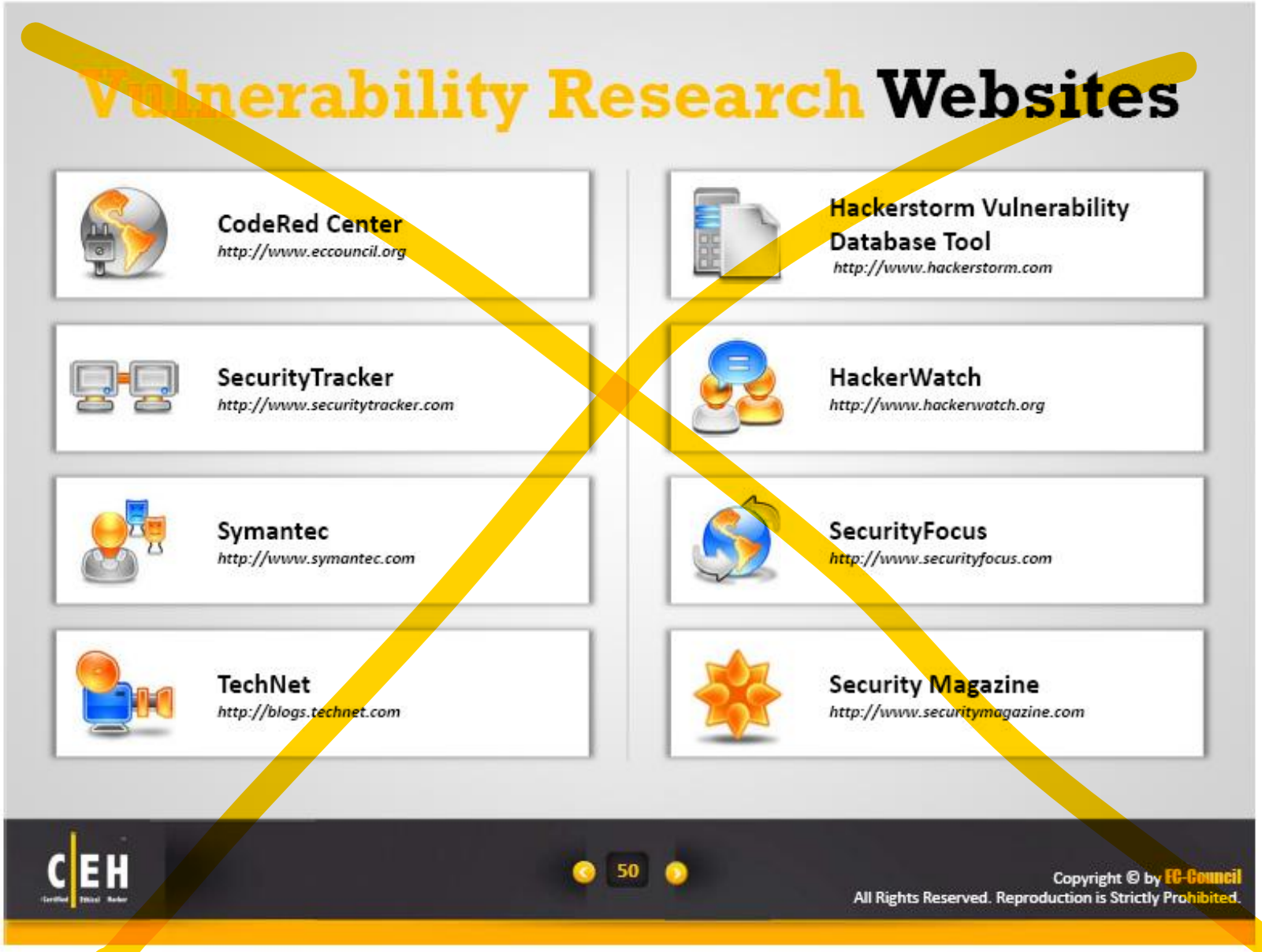
http://nvd.nist.gov

http://www.secunia.com



http://www.securiteam.com

Vulnerability Research Websites



What is Penetration Testing?

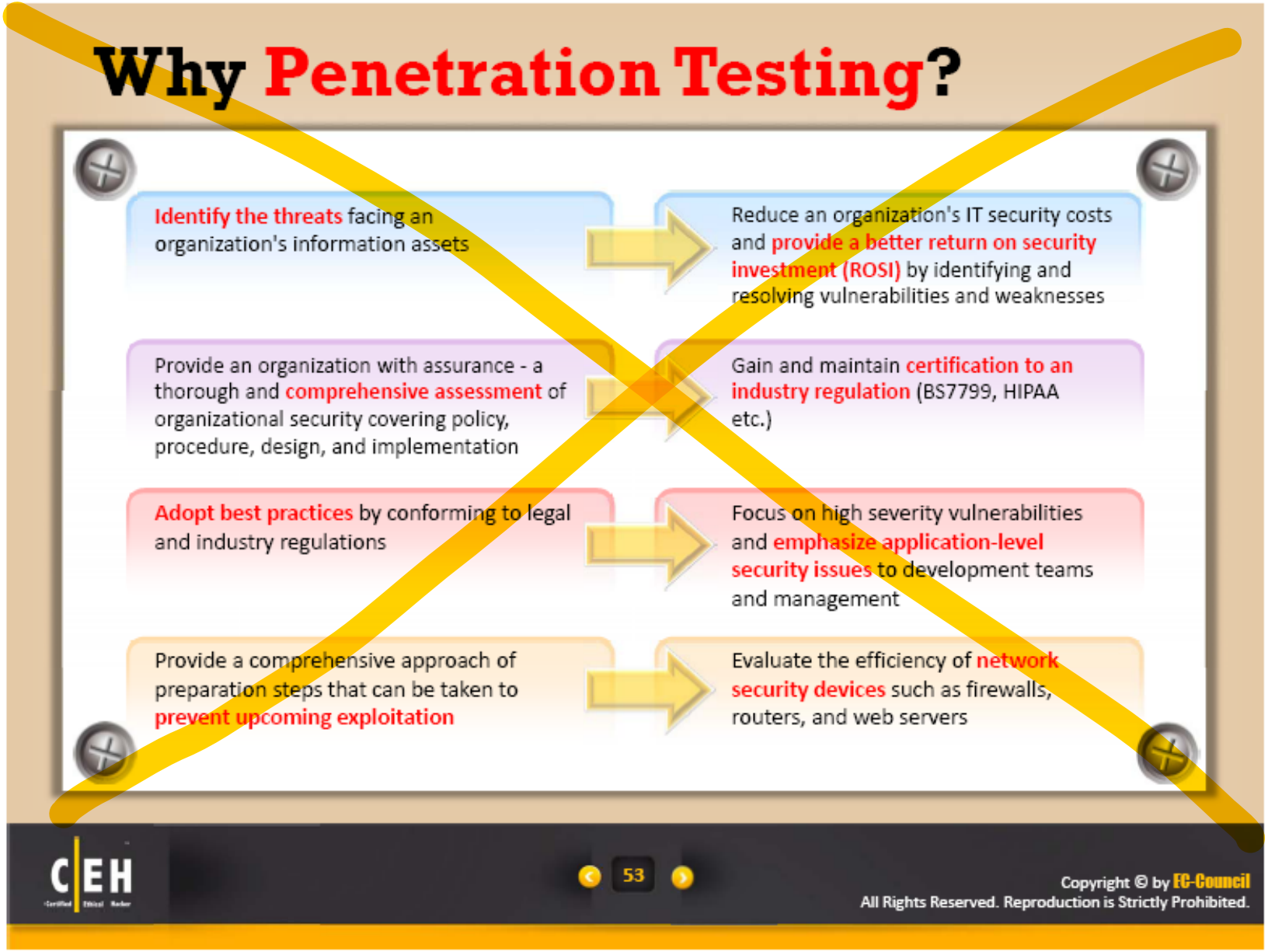
Penetration testing is a method of actively **evaluating the security of an information system** or network by simulating an attack from a malicious source

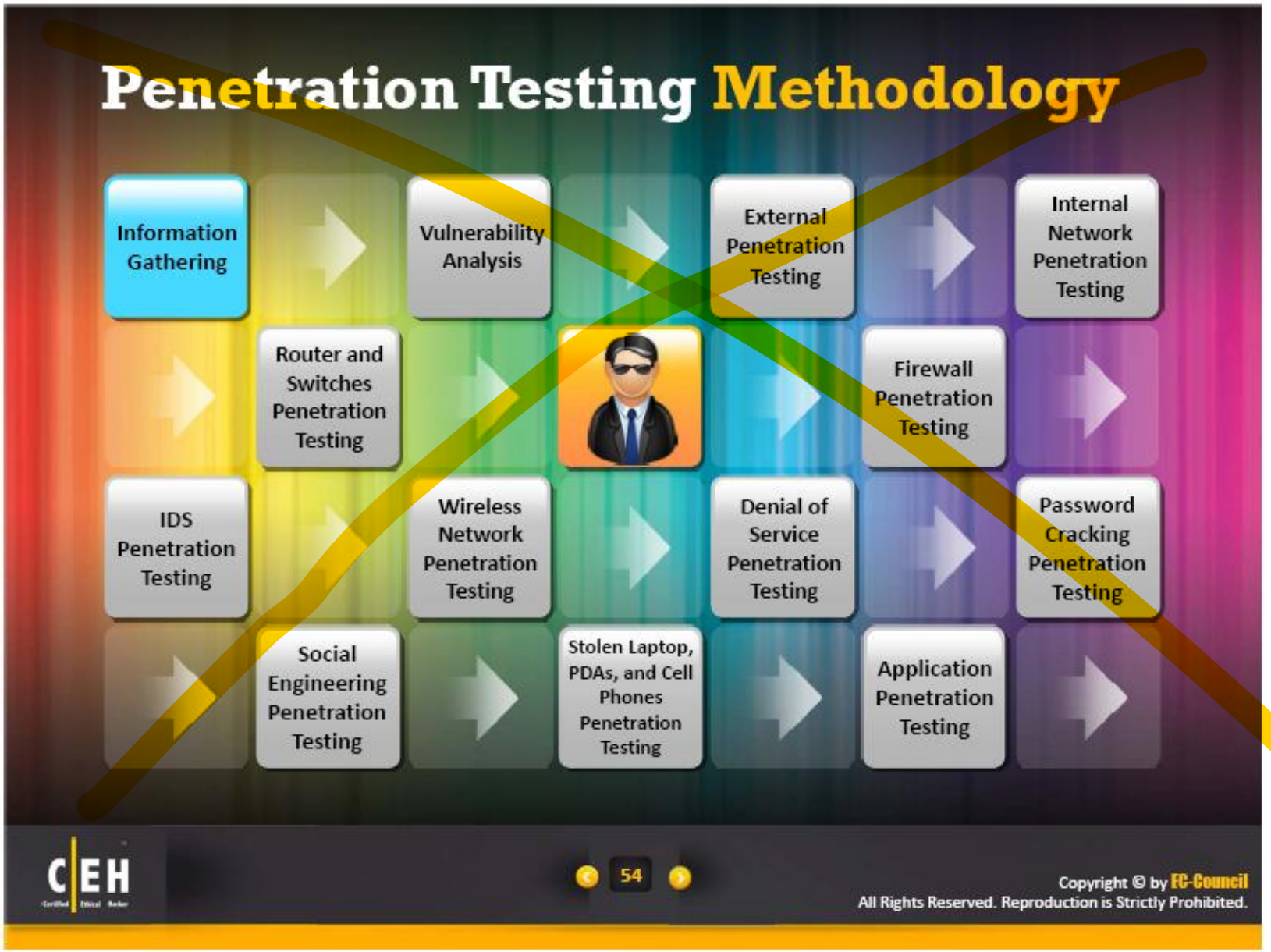
Security measures are actively analyzed for design weaknesses, technical flaws, and vulnerabilities

Black box testing simulates an attack from someone who is **unfamiliar with the system**, and white box testing simulates an attacker that has **knowledge about the system**

The results are delivered comprehensively in a **report** to executive, management, and technical audiences

Why Penetration Testing?




Penetration Testing Methodology
Information Gathering
Vulnerability Analysis
External Penetration Testing
Internal Network Penetration Testing
Router and Switches Penetration Testing
Firewall Penetration Testing
IDS Penetration Testing
Wireless Network Penetration Testing
Denial of Service Penetration Testing
Password Cracking Penetration Testing
Social Engineering Penetration Testing
Stolen Laptop, PDAs, and Cell Phones Penetration Testing
Application Penetration Testing
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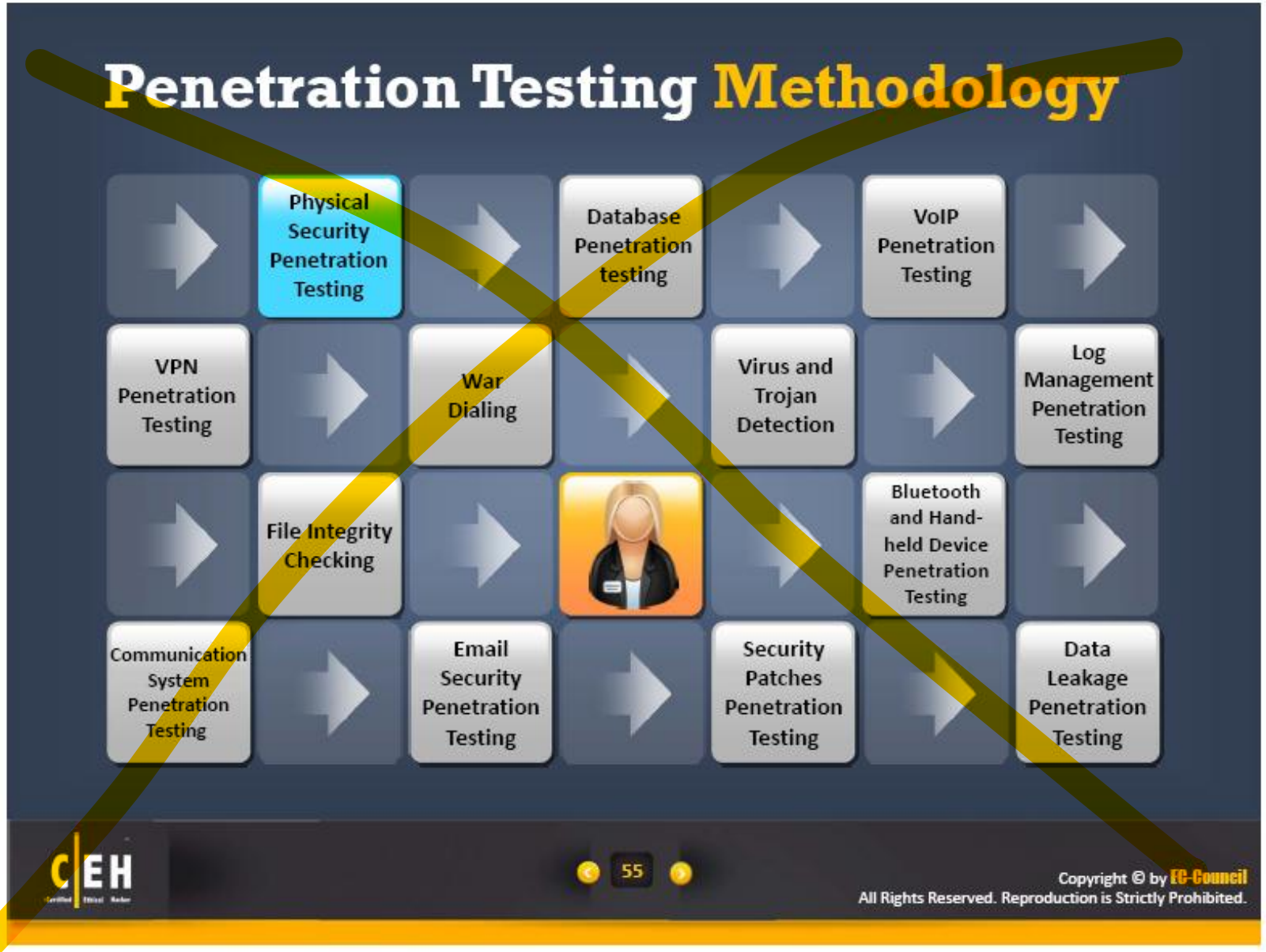
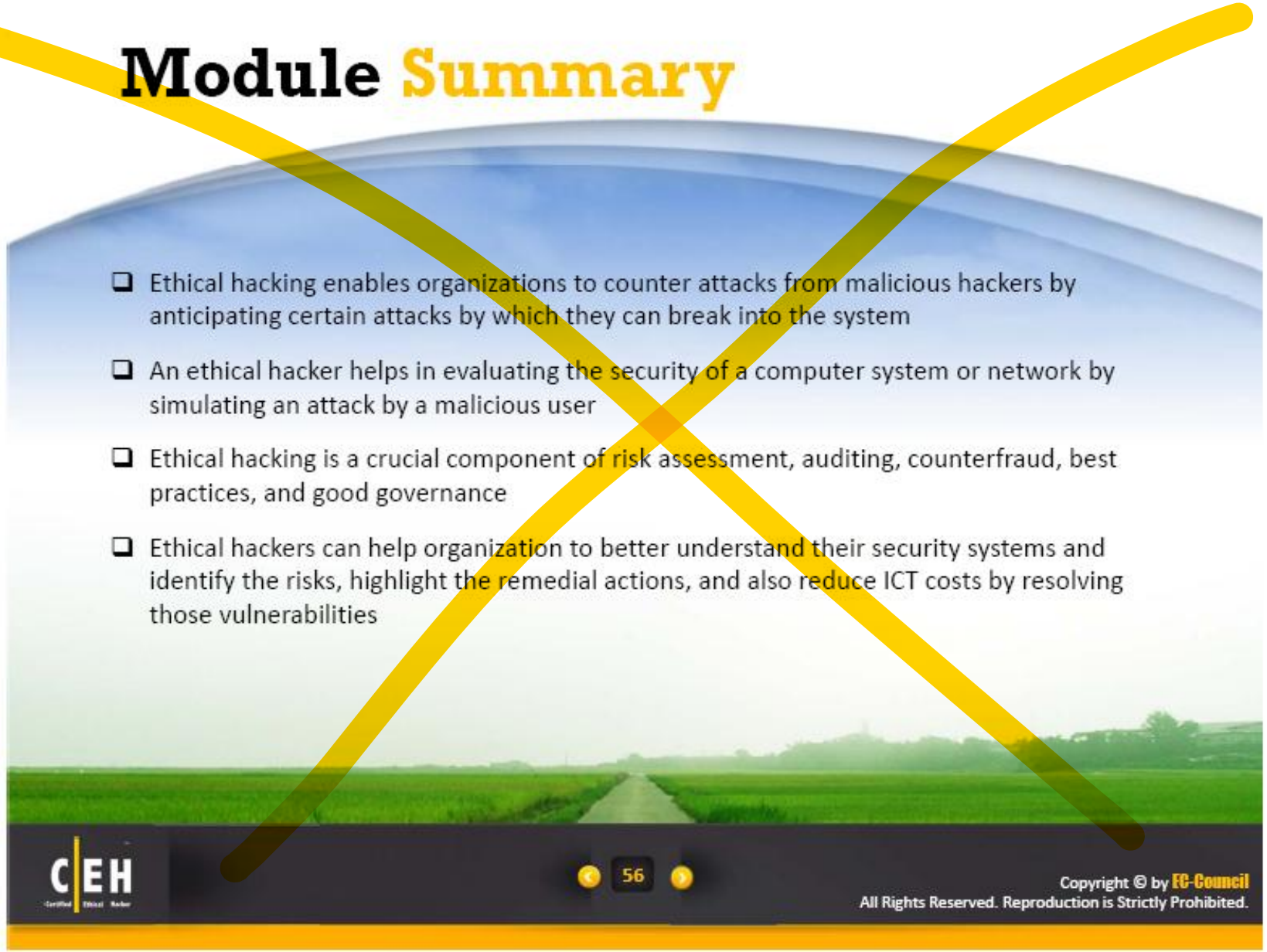
Penetration Testing Methodology



Module Summary

- Ethical hacking enables organizations to counter attacks from malicious hackers by anticipating certain attacks by which they can break into the system
- An ethical hacker helps in evaluating the security of a computer system or network by simulating an attack by a malicious user
- Ethical hacking is a crucial component of risk assessment, auditing, counterfraud, best practices, and good governance
- Ethical hackers can help organization to better understand their security systems and identify the risks, highlight the remedial actions, and also reduce ICT costs by resolving those vulnerabilities



Quotes

"The greatest enemy of knowledge is not ignorance, it is the illusion of knowledge."

- **Stephen Hawking**,
Theoretical Physicist and Cosmologist