



**CC7180NI Security Auditing and Penetration Testing**  
**Level 7**

**Evaluating Cyber Threats: A Dual Role Approach**  
**50% Individual Coursework**  
**Second Semester**  
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## Introduction

In today's digital age, financial institutions are increasingly vulnerable to cyber-attacks exploiting human error and weak security measures. This report examines a simulated bank cyber-attack that begins with a phishing email, escalates through employee account and system compromise, and culminates in a ransomware attack. The analysis explores how such incidents occur, their impact, and the importance of strengthening organizational security. This study takes the role of a Security Analyst and a CISO to describe vulnerabilities such as phishing and the spread of malware, suggest temporary containment measures and long-term solutions to address these vulnerabilities. The report makes recommendations on both technical flaws such as improving existing security policies through employee training to enhance the organizations' resilience and protection of crucial assets against cyber-attacks.

## 1. Role 1: Security Analyst Conducting Simulated Incidents

A Security Analyst plays a crucial role in protecting an organization's digital infrastructure and sensitive data from cyber threats.

### 1.1 Incident Selection & Objectives

By conducting these simulations, we can identify weaknesses, minimize risks, and strengthen the bank's security posture to handle real-world threats effectively.

#### 1.1.1 Incident 1: Phishing Attack

##### **Objective:**

Simulate a phishing attack targeting an employee to understand how attackers exploit human vulnerabilities to gain unauthorized access to sensitive systems.

##### **Expected Outcomes:**

- Test the effectiveness of employee awareness and training in recognizing phishing attempts.
- Assess the security protocols in place for detecting and preventing credential theft.
- Identify weaknesses in the authentication process and propose improvements, such as implementing multi-factor authentication (MFA).

The purpose of this simulation is to uncover gaps in employee awareness and email filtering systems that allow phishing attacks to succeed. This will help improve defenses against social engineering attacks and enhance overall security policies.

### 1.1.2 Incident 2: Malware Infection

#### **Objective:**

Simulate the Malware, such as ransomware, into the bank's critical systems to evaluate the effectiveness of endpoint protection, network monitoring, and incident response protocols.

#### **Expected Outcomes:**

- Test the bank's ability to detect and contain malware within the network.
- Identify vulnerabilities in endpoint devices and network configurations that allowed the malware to spread.
- Assess the readiness of the incident response team to mitigate and recover from the malware attack.

This simulation aims to expose gaps in the bank's malware detection and containment strategies. The results will inform the development of stronger endpoint protection, patch management, and network segmentation policies.

## 1.2 Detailed Execution Steps

This section explains how attackers use phishing to gain access, bypassed security measures, and deployed spyware and ransomware to spread across critical systems, causing significant damage.

### 1.2.1 Initial Access Gained

Steps to gain initial access:

- **Phishing File Creation:** The attacker creates a phishing file disguised as this month's office calendar.



Figure 1: Phishing email impersonating the bank's monthly calendar.

- **Phishing Email Sent:** The attacker sends the phishing email to an employee, pretending it is from their bank.

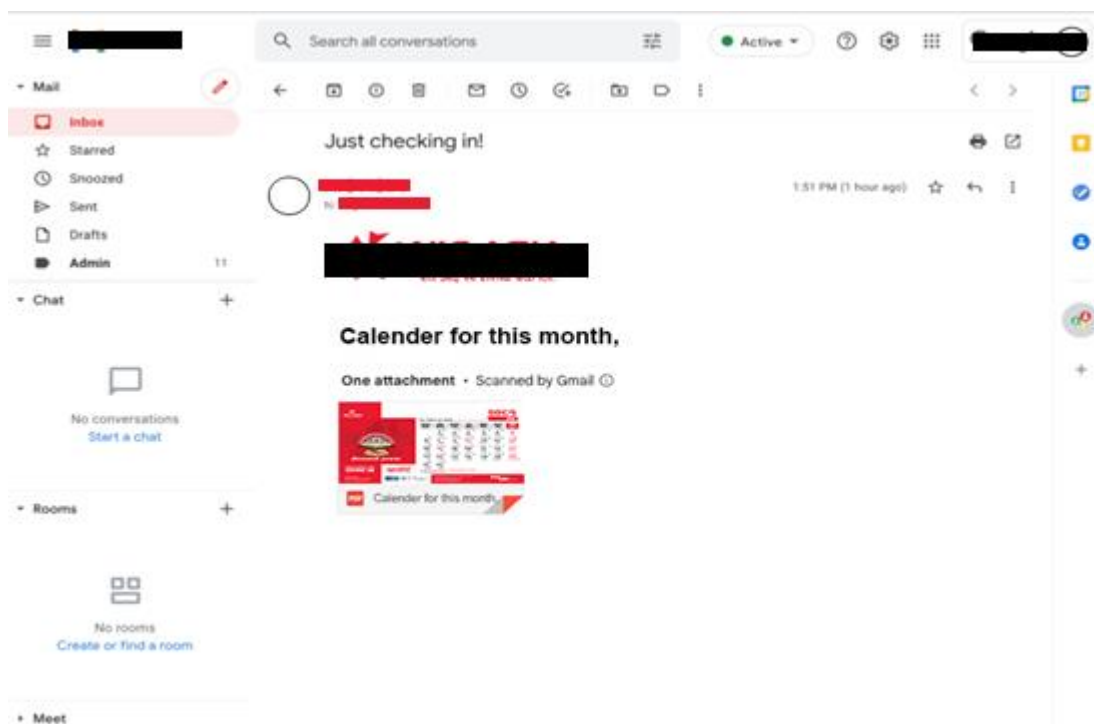


Figure 2: Attacker using a fake email address to impersonate the bank.

- **File Download:** The employee downloads the file and opens it on their device, unknowingly activating the malicious content.

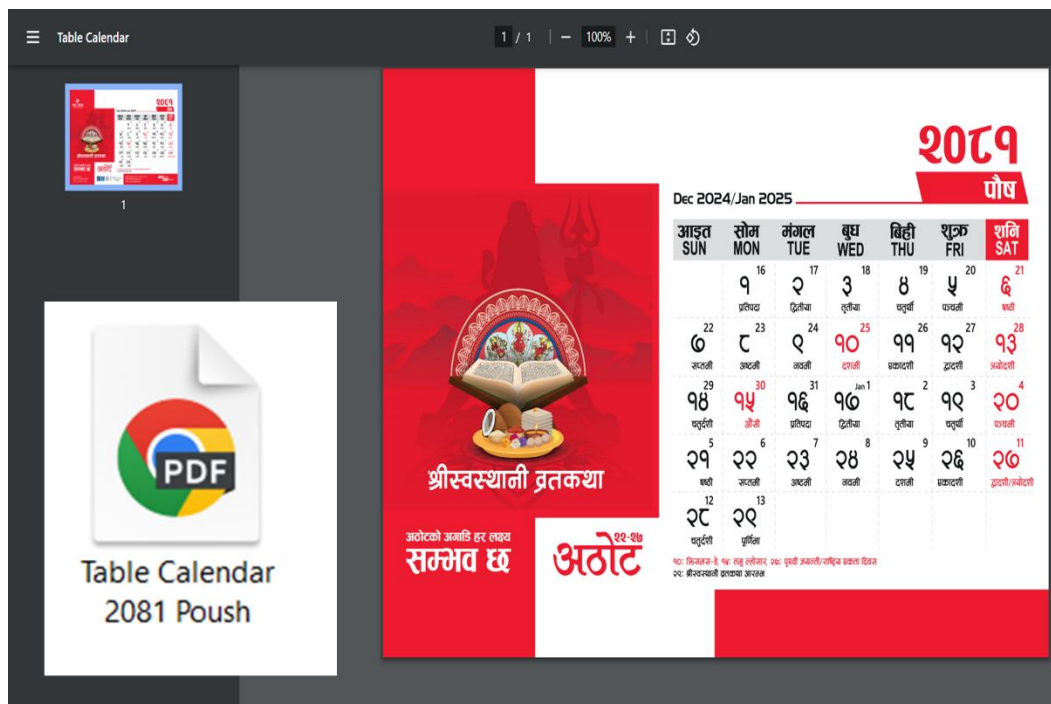


Figure 3: Employee opening the malicious PDF file.

## 1.2.2 Bypass Security Controls and Escalate Privileges

Steps to bypass security controls and escalate privileges:

- **Malicious Script Execution:** When the employee opens the PDF, a malicious backdoor script runs in the background, infecting the device without their knowledge.

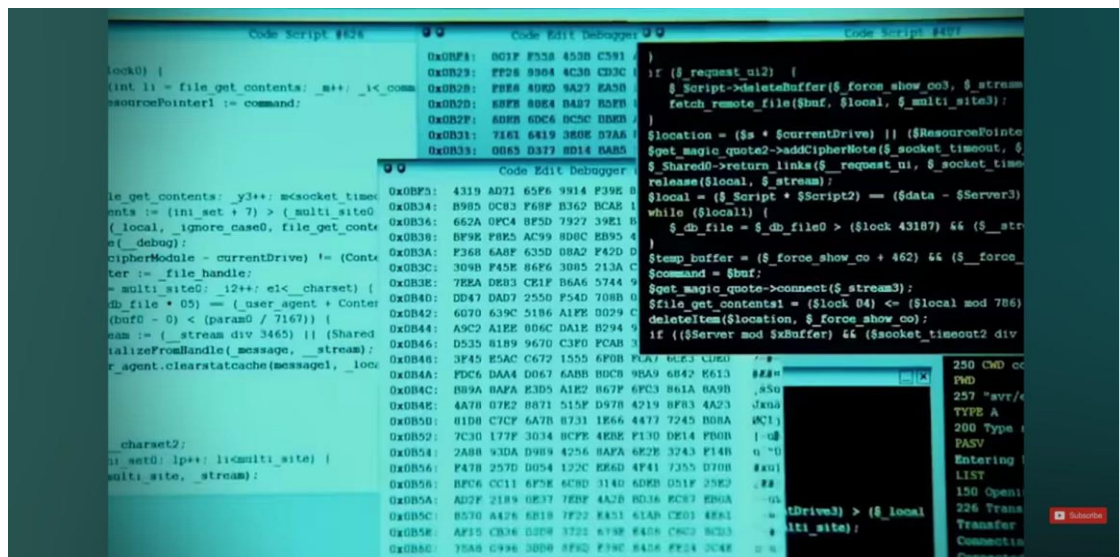


Figure 4: Backdoor script running on the device without the victim's knowledge.

- **Remote Control:** The hacker gains remote access to the infected device, allowing them to spy on and control it without the victim's awareness.



Figure 5: Hacker Secretly spying on victim's device.

**Network Exploration:** The hacker searches the network for admin devices using the infected employee's device as a gateway.

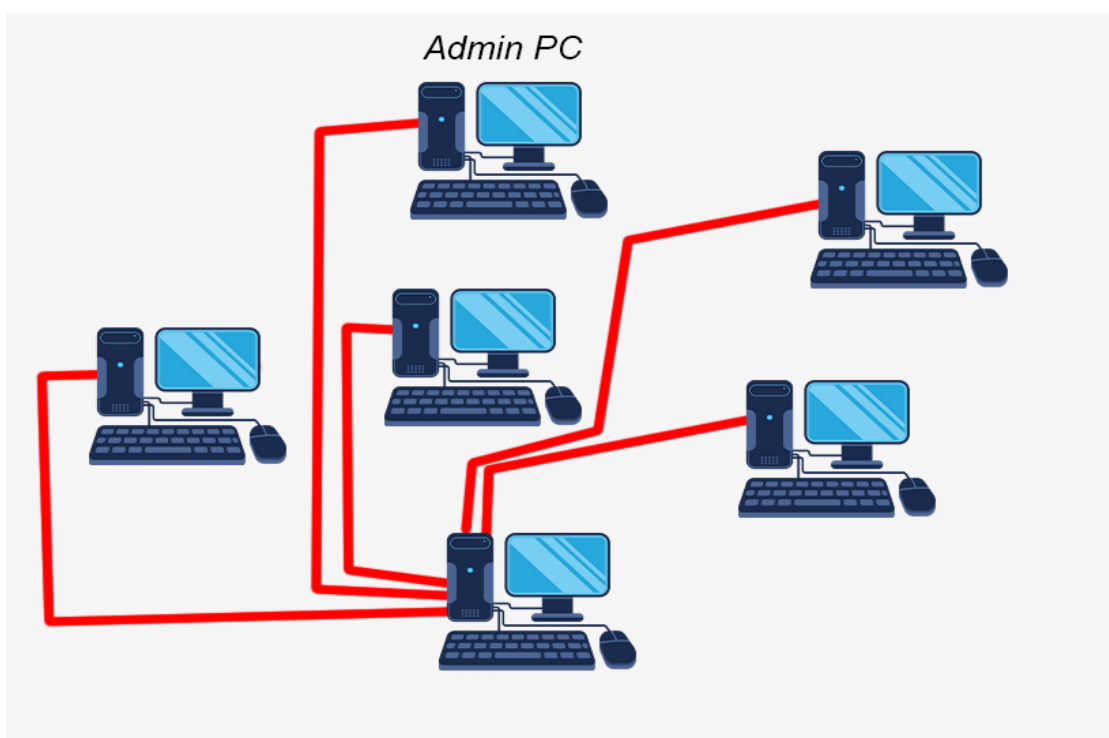


Figure 6: Hacker scanning the network to locate admin devices.

- **Admin Credential Capture:** Once the hacker obtains the credentials for the admin device, they gain full control over the system.



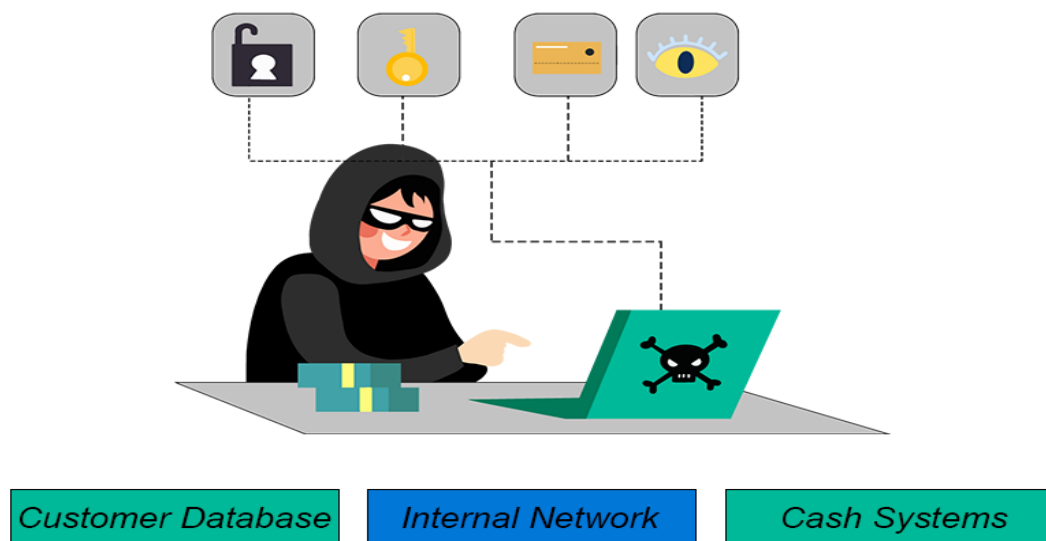


Figure 7: Hacker gaining access to the admin device.

### 1.2.3 Spread of the Attack

Steps to understand how the attack spread:

- **Data Collection and Encryption:** After gaining access to the admin device, the hacker collects sensitive data and backups before deploying ransomware to encrypt all files.

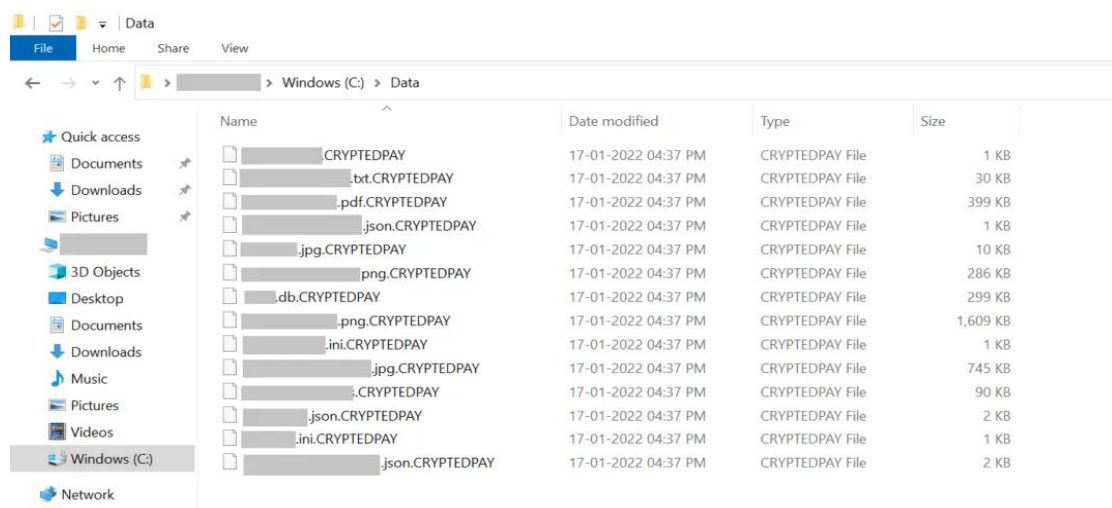


Figure 8: Ransomware encrypting all files on the system.

- **Ransom Demand:** Once file encryption is complete, the ransomware displays a message demanding a ransom for decryption.



Figure 9: Ransom demand displayed on the infected device.

### Summary of Affected Assets and Data

- **Workstations:** Employee files and emails.
- **Shared Drives:** Financial documents and Operational reports.
- **Servers:** Customer databases, transaction processing systems, and backups.
- **Customer Data:** PII, account details, and transaction history.
- **Operational Systems:** Internal tools, communication platforms, and branch connectivity.

### 1.3 Security Weaknesses Analysis

This table summarizes the key vulnerabilities and suggests improvements that could have prevented or mitigated the impact of the attack.

Security Weakness	Description	Improvement
Lack of Multi-Factor Authentication (MFA)	Employees accessed systems with only a password, allowing easy unauthorized access.	Implement MFA across all sensitive systems to add an extra layer of protection, requiring more than just a password.
Inadequate Email Filtering and Phishing Detection	Phishing emails containing malicious content bypassed email filters.	Strengthen email filters and implement anti-phishing software. Educate employees on identifying phishing emails.
Weak Endpoint Protection	The employee's workstation was unprotected, allowing malware execution.	Deploy advanced endpoint protection with behavior-based analysis to detect anomalies and block malware.
Poor Network Segmentation	Lack of segmentation allowed attackers to move laterally within the network.	Implement network segmentation to limit access to critical systems and prevent lateral movement.
Unpatched Vulnerabilities	Outdated software with unpatched vulnerabilities allowed the attacker to exploit it.	Implement a robust patch management system to regularly update systems and close security gaps.
Weak Access Control Policies	Insufficient access controls allowed unauthorized lateral movement.	Enforce strict access control policies, following the principle of least privilege, to restrict unnecessary access.
Inadequate Employee Security Training	Employees lacked awareness of phishing and other security threats.	Conduct regular cybersecurity training, including simulated phishing exercises, to enhance employee awareness.
Lack of Incident Detection and Monitoring Systems	The breach was undetected for a long period, allowing extensive damage.	Implement continuous monitoring and intrusion detection systems (IDS) to detect and respond to threats promptly.

Figure 10: Table Security Weaknesses

## 1.4 Impact Assessment

The simulated cyber-attack on the bank would lead to significant financial, operational, and reputational consequences. Financially, the bank would face ransom payments, incident response costs, system restoration, and potential regulatory fines. Operationally, system outages and disrupted services would delay transactions and customer support, causing loss of productivity and business. Reputational damage would result from the breach of sensitive customer data, eroding client trust and damaging the bank's credibility in the industry. Long-term



impacts could include customer attrition, negative publicity, and reduced market share. The attack highlights the urgent need for enhanced cybersecurity measures to mitigate these risks.

## **2. Role 2: CISO Preparing Incident Report and Special IS Audit**

The CISO is responsible for developing and implementing an organization's information security strategy to protect data, systems, and networks from cyber threats. (Security Shout, 2024)

### **2.1 Executive Summary**

This report simulates a multi-stage cyber-attack on the bank to identify weaknesses in its defenses. The attack began with a phishing email targeting an employee, leading to compromised credentials and unauthorized access to their workstation due to the absence of MFA. The attacker exploited unpatched vulnerabilities and weak network segmentation to move laterally, ultimately deploying ransomware and encrypting critical data, causing operational disruptions and potential data loss.

The review highlighted vulnerabilities such as inadequate endpoint protection, insufficient email filtering, and the absence of real-time intrusion detection. The financial risks include ransom payments, restoration costs, regulatory fines, and reputational damage from downtime and data breaches.

To address these issues, the report recommends implementing MFA, enhancing email security and endpoint protection, improving network segmentation, and adopting robust patch management and offline backup strategies. Real-time monitoring systems and employee training on phishing attack identification are also critical. These measures will strengthen the bank's cybersecurity posture and safeguard customer trust.

### **2.2 Detailed Incident Report**

The simulated cyber-attack targeted the bank's infrastructure in a multi-stage process, beginning with a phishing email that compromised an employee's credentials. Exploiting these credentials, the attacker accessed the employee's

workstation and social media account. The lack of multi-factor authentication (MFA) facilitated unauthorized entry. Subsequently, the attacker leveraged unpatched vulnerabilities and poor network segmentation to move laterally within the network, ultimately compromising critical systems, including customer databases and transaction servers. Ransomware was deployed, encrypting sensitive data and halting operations.

### **Affected Systems and Data**

- **Systems Impacted:** Employee workstations, internal servers, customer databases, and transaction processing systems.
- **Data at Risk:** Customer personal and financial information, operational data, transaction logs, and critical backup files.

### **Severity and Business Impact**

- **Severity:** High. The incident disrupted core operations, compromised sensitive customer data, and posed long-term financial and reputational risks.
- **Operational Impact:** Critical services, including transaction processing, loan disbursements, and customer support, were rendered unavailable, causing significant delays and customer dissatisfaction.
- **Financial Impact:** Costs include potential ransom payment, system restoration, regulatory fines for non-compliance, and expenses for strengthening security measures.
- **Reputational Impact:** Trust erosion among customers due to service downtime and the potential exposure of sensitive data. This may lead to customer attrition and negative publicity.

This incident underscores the urgent need for robust security measures, such as MFA, advanced endpoint protection, and network segmentation, to prevent similar attacks in the future. Enhanced incident response protocols and employee training are critical to mitigating risks and protecting organizational assets.

## 2.3 Containment and Remediation Measures

By taking these steps, the organization can mitigate the current incident's impact, restore secure operations, and fortify its defenses against future cyber threats.

### 2.3.1 Immediate Containment Measures:

- **Isolate Affected Systems:** Disconnect compromised workstations and servers from the network to prevent further lateral movement by the attacker.
- **Disable Compromised Accounts:** Immediately disable the compromised employee account and any other accounts suspected of being accessed by the attacker.
- **Block Malicious Communication:** Identify and block the attacker's command-and-control (C2) channels by updating firewall rules and monitoring network traffic.
- **Deploy Incident Response Team:** Activate the organization's incident response team to coordinate containment efforts and perform forensic analysis.

### 2.3.2 Remediation Steps

- **Eradicate Malware:** Perform a thorough scan of affected systems using advanced endpoint protection tools to detect and remove ransomware and other malicious software.
- **Patch Vulnerabilities:** Apply patches to all known vulnerabilities exploited during the attack, including operating systems and applications.
- **Enhance Access Controls:** Implement multi-factor authentication (MFA) across all systems and restrict access to critical assets using role-based access controls.
- **Secure Backups:** Restore encrypted data from secure, offline backups after verifying their integrity. Ensure backups are inaccessible from the primary network in the future.

### 2.3.3 Steps to Restore Secure Operations

- **Rebuild Systems:** Reimage compromised systems and servers to eliminate any residual malware.

- **Conduct Security Audit:** Perform a comprehensive audit to identify gaps in existing security controls and implement necessary improvements.
- **Strengthen Monitoring:** Deploy advanced intrusion detection and prevention systems (IDPS) to monitor anomalous activities.
- **Employee Awareness:** Conduct immediate cybersecurity training for employees to recognize phishing attempts and report suspicious activities promptly.

### 2.3.4 Long-Term Measures

- Develop and test an updated incident response plan.
- Regularly review and revise security policies to align with emerging threats.
- Conduct periodic vulnerability assessments and penetration testing to ensure continued resilience.

## 2.4 Special IS Audit

This audit table examines the security weaknesses that allowed the phishing attack and subsequent ransomware deployment to succeed within the bank's network. It evaluates the vulnerabilities in the affected systems, the effectiveness of the existing security controls, and identifies necessary revisions to policies for enhanced future protection. The following table summarizes the findings of a Special Information Security Audit conducted on the affected assets after the simulated incident:

Audit Area	Assessment Criteria	Findings	Vulnerabilities Contributed to Incident	Risk Level	Effectiveness of Security Controls	Recommendations	Policies Needing Revision
Access Controls	Are MFA and strong password policies in place?	No MFA implemented; weak password policies observed.	Lack of MFA allowed unauthorized access through compromised credentials.	High	Weak password policies and absence of MFA allowed easy access.	Implement MFA for all systems, enforce password complexity, and regular credential reviews.	Revise password policy to enforce complexity and MFA.
Endpoint Security	Are workstations protected with up-to-date antivirus/anti-malware?	Outdated endpoint protection; no advanced threat detection tools deployed.	Inadequate endpoint protection allowed ransomware to execute undetected.	High	Endpoint protection was not capable of detecting malicious activity.	Upgrade endpoint protection solutions with behavioral analysis capabilities and automate updates.	Review endpoint protection policy and ensure regular updates.
Patch Management	Are all systems patched and updated regularly?	Multiple unpatched systems with known vulnerabilities.	Unpatched systems provided easy access for malware execution and privilege escalation.	High	Patch management process is not enforced consistently.	Establish a robust patch management process to ensure timely updates.	Revise patch management policy to include automated updates and regular audits.

Network Segmentation	Is the network segmented to restrict lateral movement?	Inadequate segmentation; critical assets accessible without strict access controls.	Lack of segmentation allowed lateral movement to critical systems after initial breach.	High	No segmentation in place, allowing unrestricted access to sensitive systems.	Segment the network into zones based on asset criticality and deploy firewalls to control inter-segment communication.	Revise network architecture policies to enforce segmentation.
Email Security	Are email filtering and anti-phishing tools effective?	Ineffective email filtering; phishing emails bypassed existing controls.	Phishing email was allowed to reach the employee's inbox, leading to credential theft.	High	Email filtering and anti-phishing controls were insufficient.	Deploy advanced email filtering tools with phishing detection capabilities.	Revise email security policy to include advanced phishing detection tools.
Monitoring & Detection	Are IDS and SIEM tools deployed to detect and respond to threats?	No real-time monitoring or automated intrusion detection systems in place.	Lack of monitoring allowed the attacker to remain undetected while spreading.	High	No real-time intrusion detection systems or SIEM tools in place.	Deploy IDS and SIEM tools to monitor and respond to suspicious activities in real time.	Revise security monitoring policy to include continuous monitoring and alerts.
Backup Strategy	Are backups secure, encrypted, and tested for restoration?	Backups were vulnerable to ransomware; no offline or encrypted backups maintained.	Backup systems were easily compromised and encrypted by the attacker.	High	Backups were not protected or tested for recovery.	Store backups offline, encrypt them, and regularly test restoration processes.	Revise backup policy to include offline, encrypted backups and testing.
Employee Awareness	Are employees trained on cybersecurity best practices?	Employees unaware of phishing risks; no regular training conducted.	Lack of awareness led to employee's interaction with a phishing email.	Medium	No regular cybersecurity training or phishing simulations for employees.	Conduct regular cybersecurity awareness programs and phishing simulations.	Update employee training policy to include regular cybersecurity sessions.
Incident Response	Are response plans tested and updated regularly?	No formal incident response plan in place; ad-hoc responses observed.	Absence of a defined plan led to delayed containment and response actions.	Medium	Incident response procedures were unprepared and untested.	Develop and test a formal incident response plan, ensuring stakeholders are trained on its execution.	Revise incident response policy to ensure preparedness and regular testing.
Data Protection	Are data encryption and access policies in place?	Sensitive customer data not encrypted in storage; insufficient access control mechanisms.	Lack of data encryption exposed sensitive information, leading to possible data theft.	High	No encryption or strong access control for sensitive data.	Encrypt sensitive data at rest and in transit, and enforce stricter access policies based on roles and responsibilities.	Revise data protection policies to ensure comprehensive encryption and access control.
Compliance	Does the organization adhere to applicable regulations (e.g., GDPR, PCI DSS)?	Potential non-compliance with data protection regulations.	Lack of regulatory compliance led to exposure of sensitive data without adequate safeguards.	High	No clear evidence of regulatory compliance checks or audits.	Perform a compliance audit to identify and rectify gaps in regulatory adherence.	Revise compliance policies to ensure regular audits and adherence to regulations.

Figure 11: Table Special IS Audit

## 2.5 Recommendations for Future Prevention

The recommendations to improve the security of banks to prevent similar attacks in the future are:

- **MFA:** The use of multi-factor authentication on sensitive systems could prevent unauthorized access in the event of stolen credentials.
- **Enhanced Email Filtering:** Enhancing email security to block phishing attempts and malicious links would have reduced the risk of phishing attacks.
- **Enhanced Protection:** Advanced protection mechanisms can detect and block malware, including ransomware, on employee devices.
- **Patch Management:** Regular patching of the systems along with automated scanning for vulnerabilities can help reduce the risks.
- **Network Segmentation:** Network segmentation minimizes lateral movement by reducing unauthorized access to critical systems.
- **Continuous Monitoring:** Implement SIEM and intrusion detection to provide monitoring for suspicious activities for early detection.
- **Secure Backups:** Secure encrypted backups stored offline should be kept and regularly tested for data recovery if a ransomware attack occurs.
- **Employee Training:** Regular cybersecurity awareness training should be provided for the employees to help them identify threats and protect sensitive information.
- **Incident Response Plans:** Incident response and recovery plans should be developed and tested to ensure quick and effective reactions against cyber-attacks.
- **Review and Update Security Policy:** Periodically revise the security policy based on emergent threats. Compliance with best practices also demands such revisions.

This will assist the bank in reducing vulnerabilities, developing better security measures, and protecting itself more effectively from cyber threats.

## Conclusion

This report details a simulated multi-stage cyber-attack on a bank, starting with a phishing attack and culminating in ransomware deployment. It highlights critical vulnerabilities, including insufficient employee training, lack of multi-factor authentication, weak endpoint protection, and poor network segmentation. The attack's potential financial, operational, and reputational damage underscores the urgency of proactive security measures. An IS audit identified key areas for improvement, such as patch management, backup strategies, and incident response plans. Recommendations focus on enhancing email filtering, implementing stronger authentication, and conducting regular employee training. By adopting these measures, the bank can significantly reduce cyber risks, safeguard critical assets, and maintain customer trust.

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