ENHANCING CYBERSECURITY IN ACS DEPARTMENT

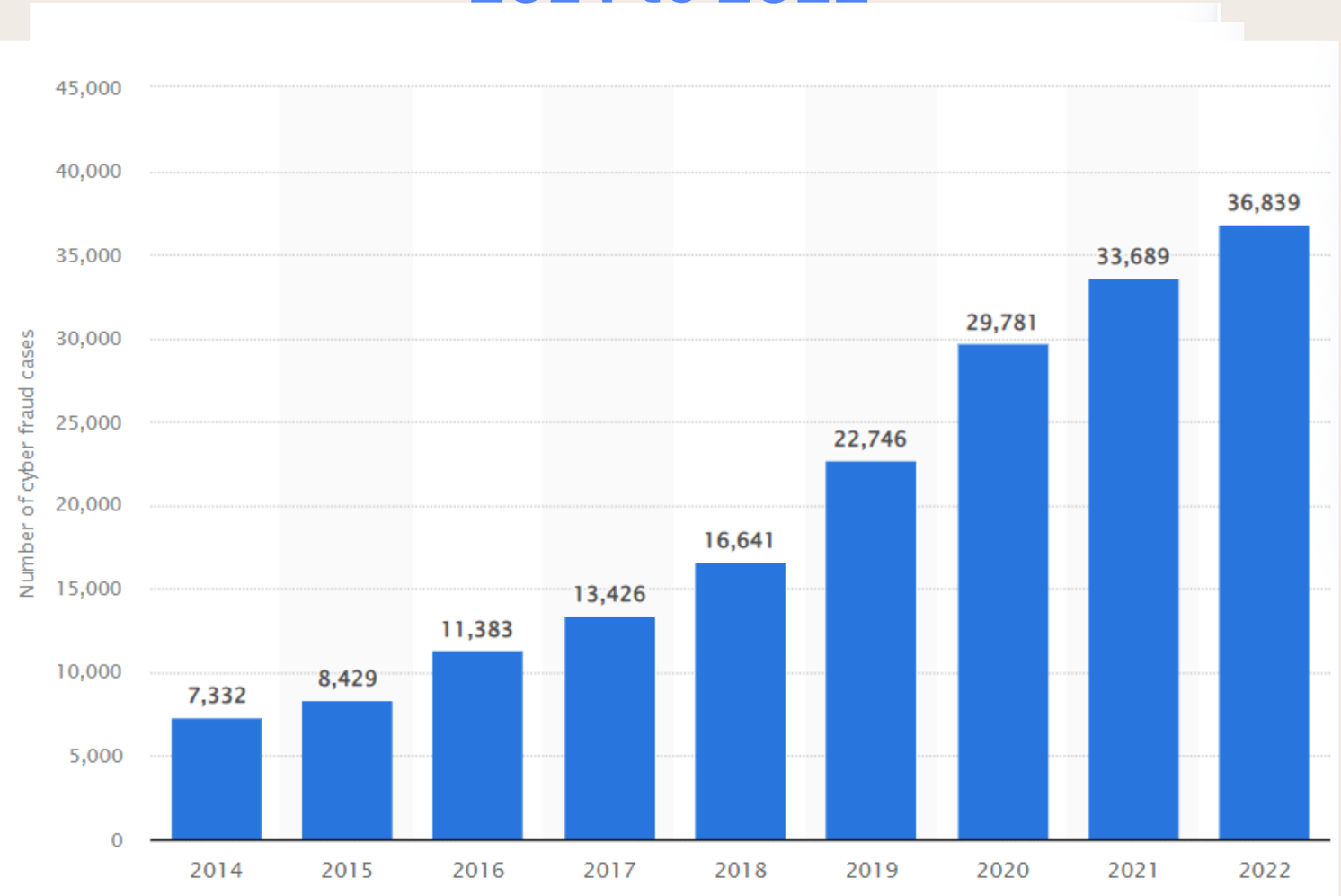
RESEARCH PROJECT

PRESENTED BY VI LE

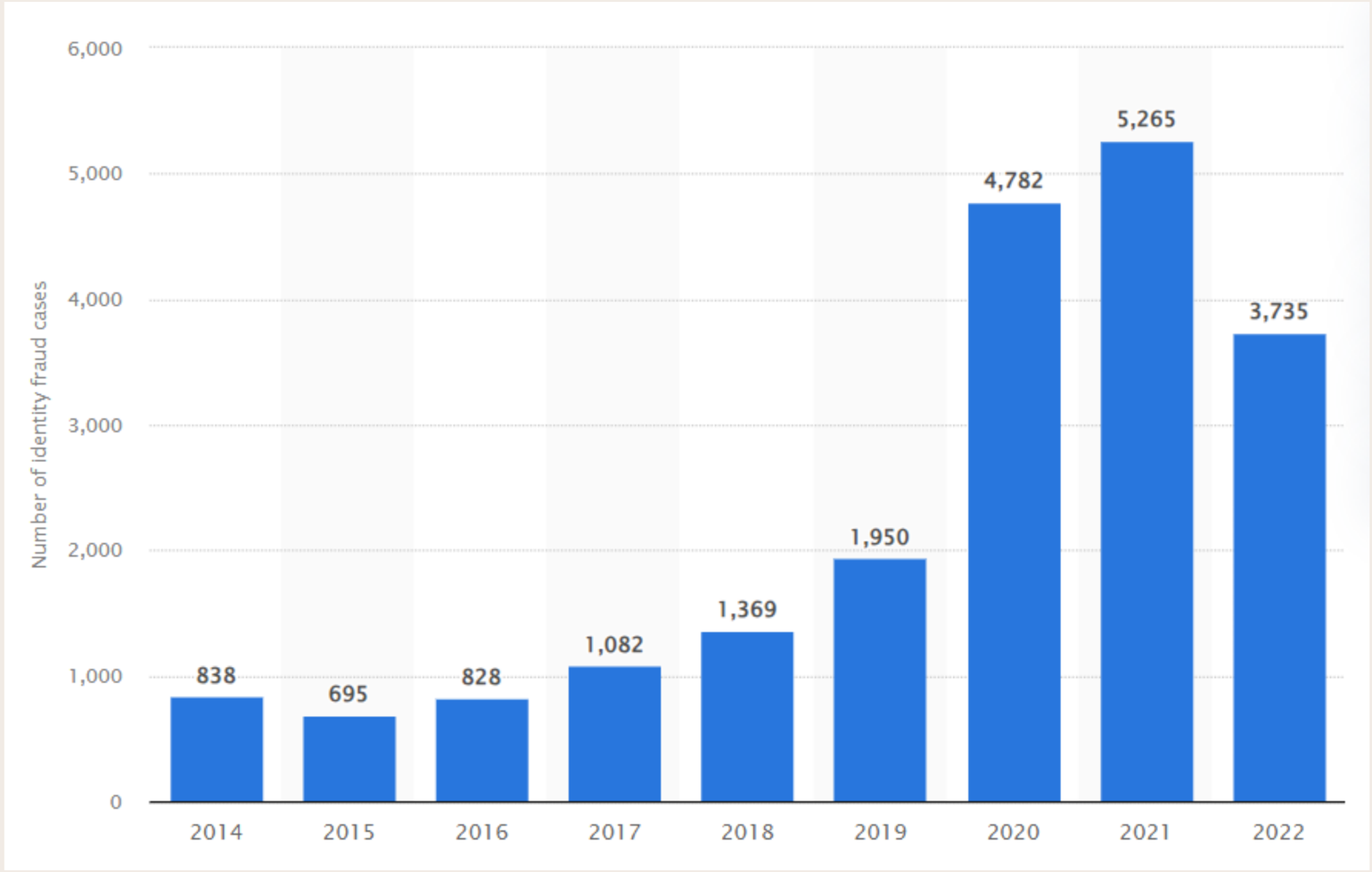
BACKGROUND

- “44% increase in cyberattack since 2022” - Checkpoint Blog
- 2200 cyberattacks every day according to research in 2017
- 28778 new vulnerabilities was discovered in 2023, an increase of more than 3000 compared to 2022 according to CVE
- A recent cyberattack at the University of Winnipeg occurred on March 24, 2024

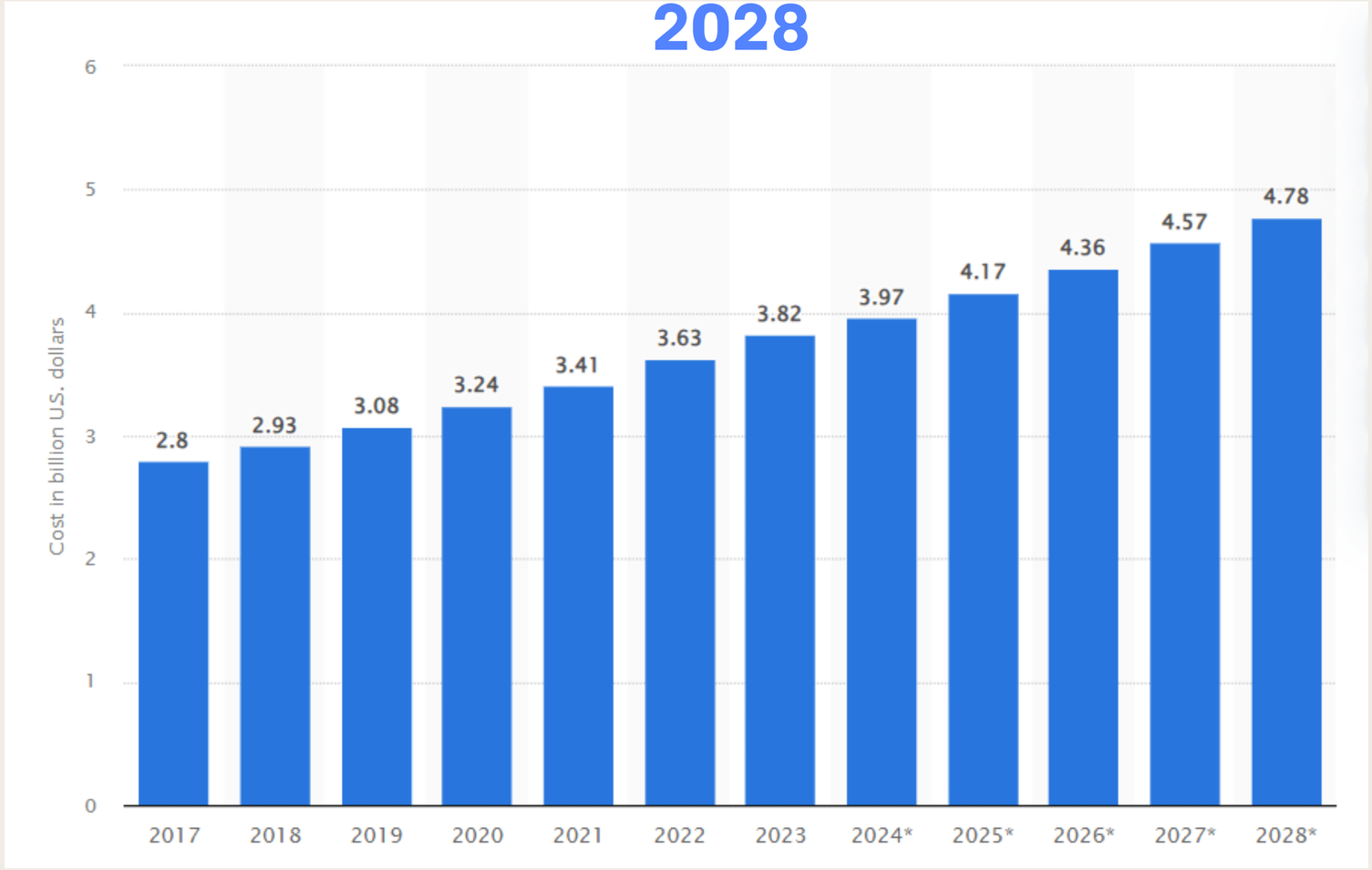
Number of police-reported instances of internet fraud in Canada from 2014 to 2022



Number of police-reported instances of online identity fraud in Canada from 2014 to 2022



Estimated annual cost of cybercrime in Canada from 2017 to 2028



OBJECTIVES

1 Investigate past cyber attacks within ACS department.

2 Analyze attack methods, attack surfaces, and damage caused due to those past attacks.

3 Review current systems, critical assets, and architectural design of ACS department

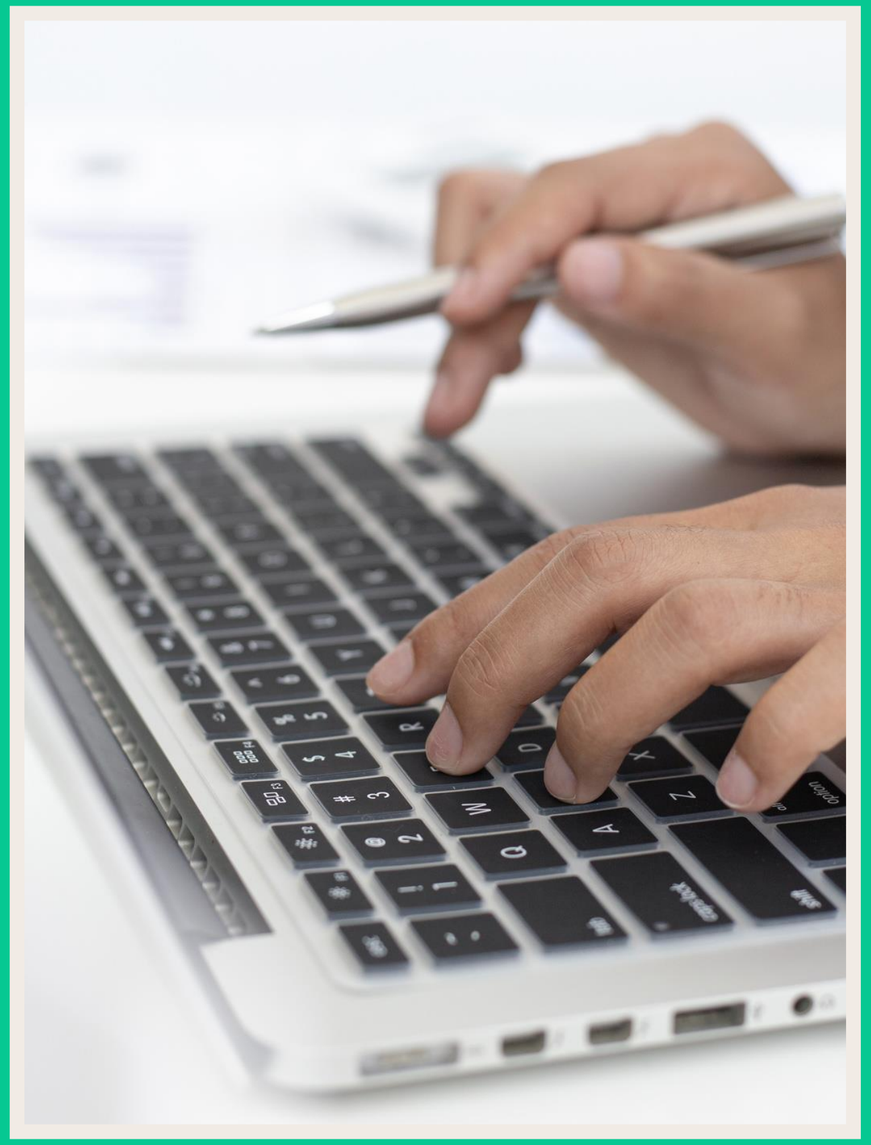
4 Evaluate current protocols, and security policies of ACS department

5 Evaluate the effectiveness of current control mechanisms, defensive measures implemented in ACS department’s system.

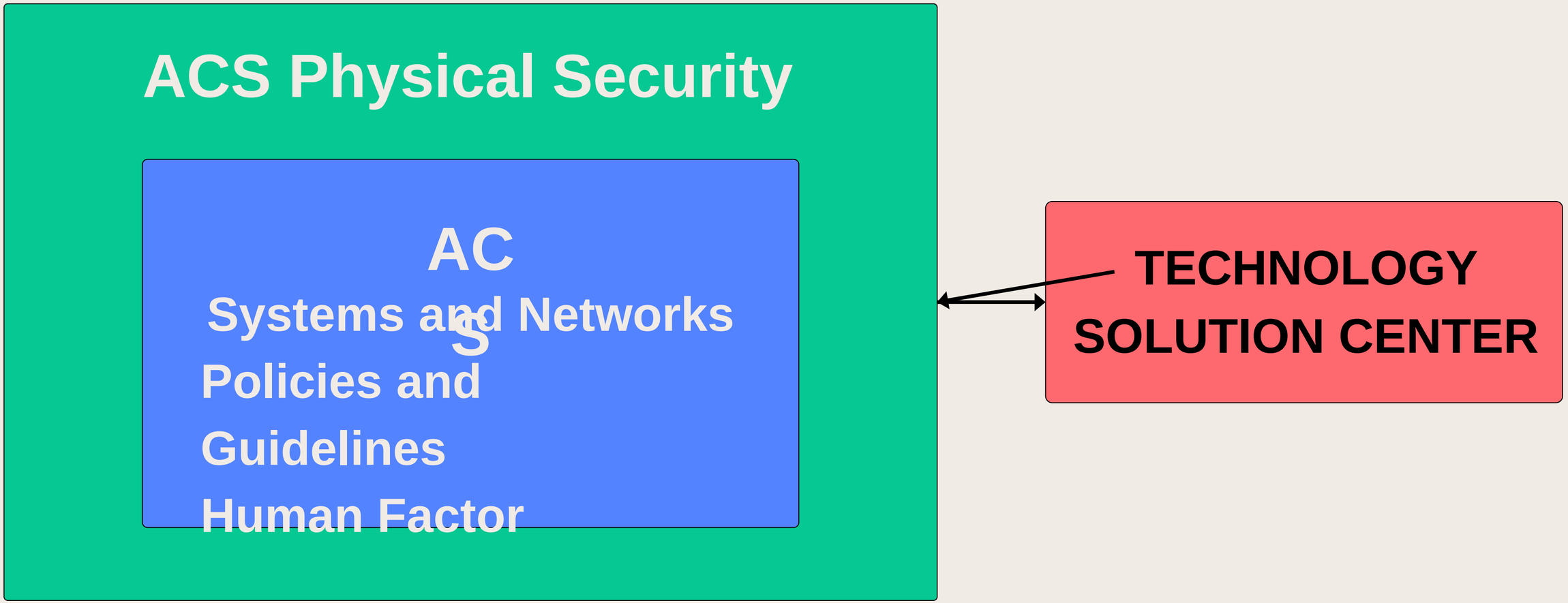
6 Conduct risk analysis and propose strategies to mitigate those risks.

7 Design an incident response plan for ACS department.

8 Design penetration testing plan for ACS department



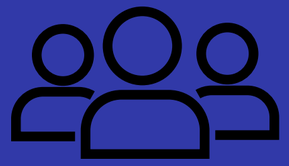
SCOPE OF RESERACH



CHALLENGES UNIQUE TO ACADEMIC SETTING

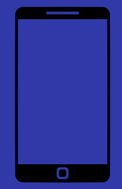
1. Limited Academic Literatures about Subject

2. Culture of Openess



3. Decentralized Systems

4. Bring Your Own Device Policy



5. IoT Adoption

METHOLOGY

1. Conduct Interviews

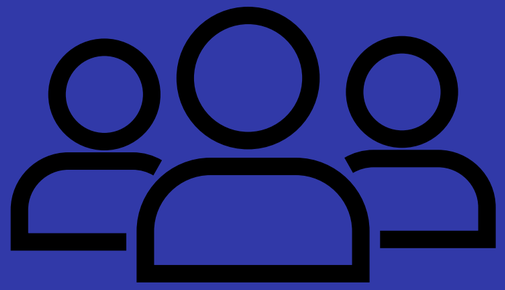
2. Do Interview Analysis

3. Create High-level network diagram of ACS

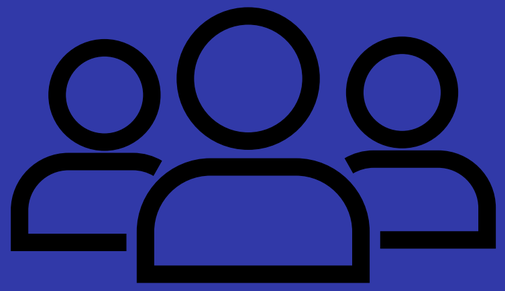
4. Conduct Threat Modeling

5. Risk Evaluation

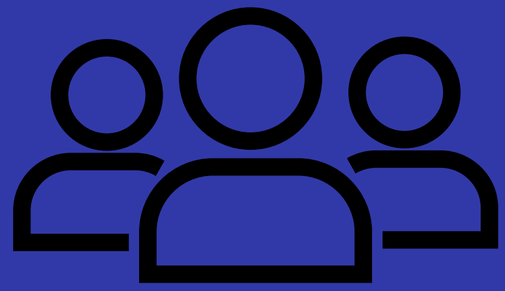
PARTICIPANTS



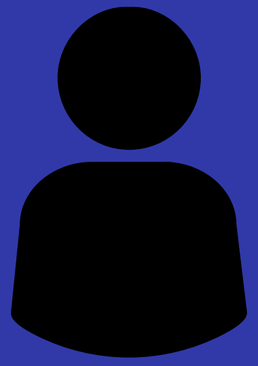
Students



Faculty member



Administrator
/
Technician



A member of Information Security Managment

INTERVIEW QUESTION SETS

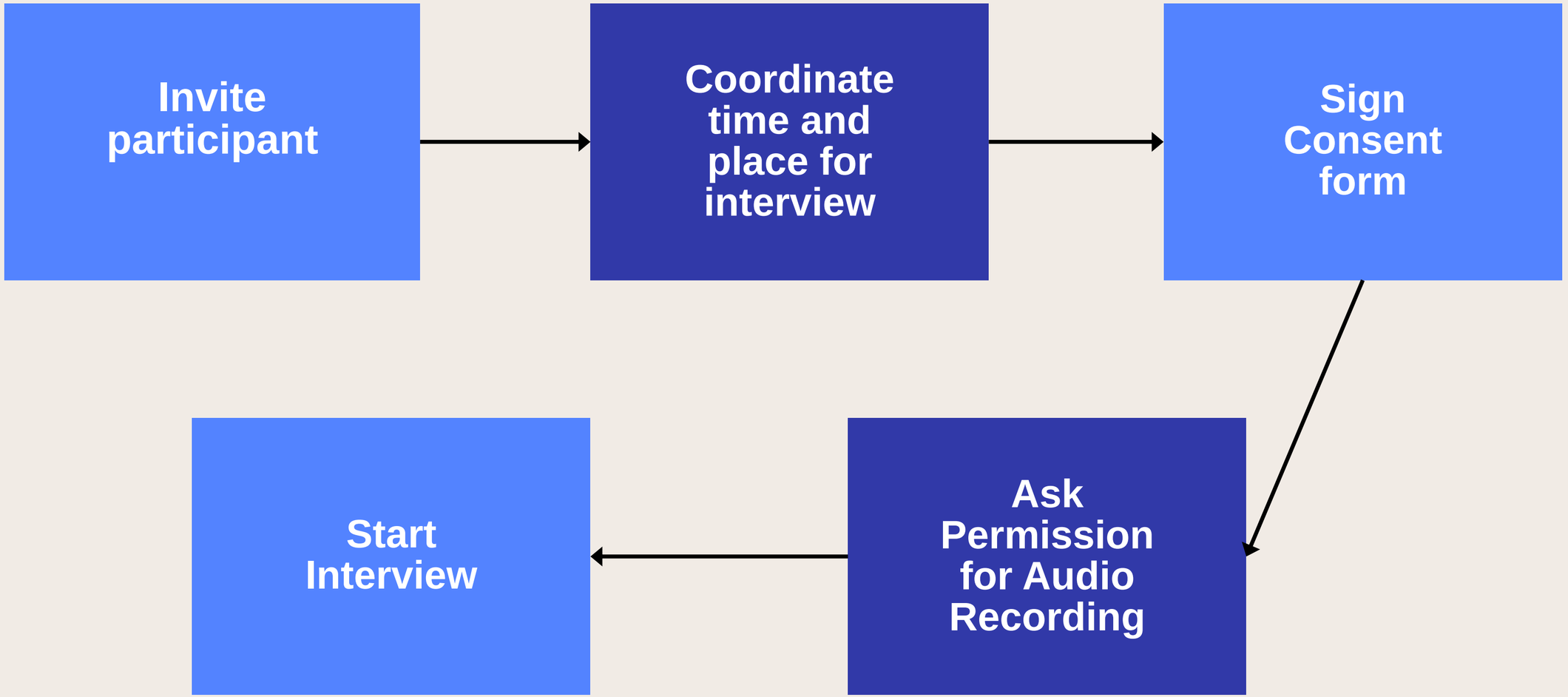
Students

Faculty member

Administrator
/
Technician

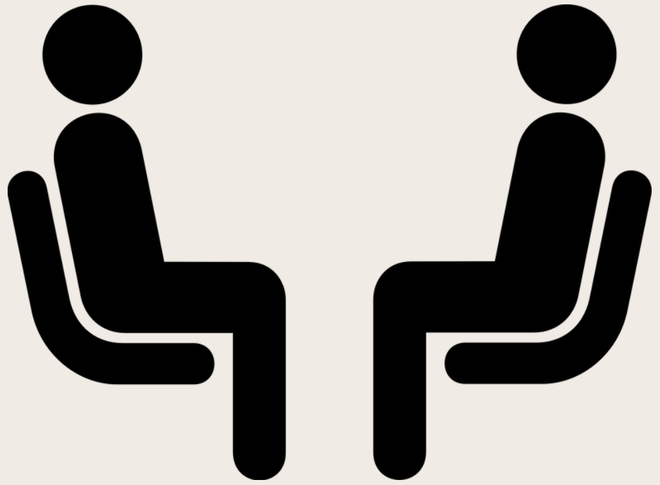
A member of Information Security Managment

INTERVIEW PROCESS



INTERVIEW ANALYSIS

Quantitative Data



Qualitative Data

SOME QUANTITATIVE DATA

Most significant cybersecurity threats according to student	Number of Student	Total Student Count
Phishing	3	7
Social engineering	1	7
Stolen important information	2	7
Disruption of service	2	7
Ransomware	1	7
Man in the middle	1	7

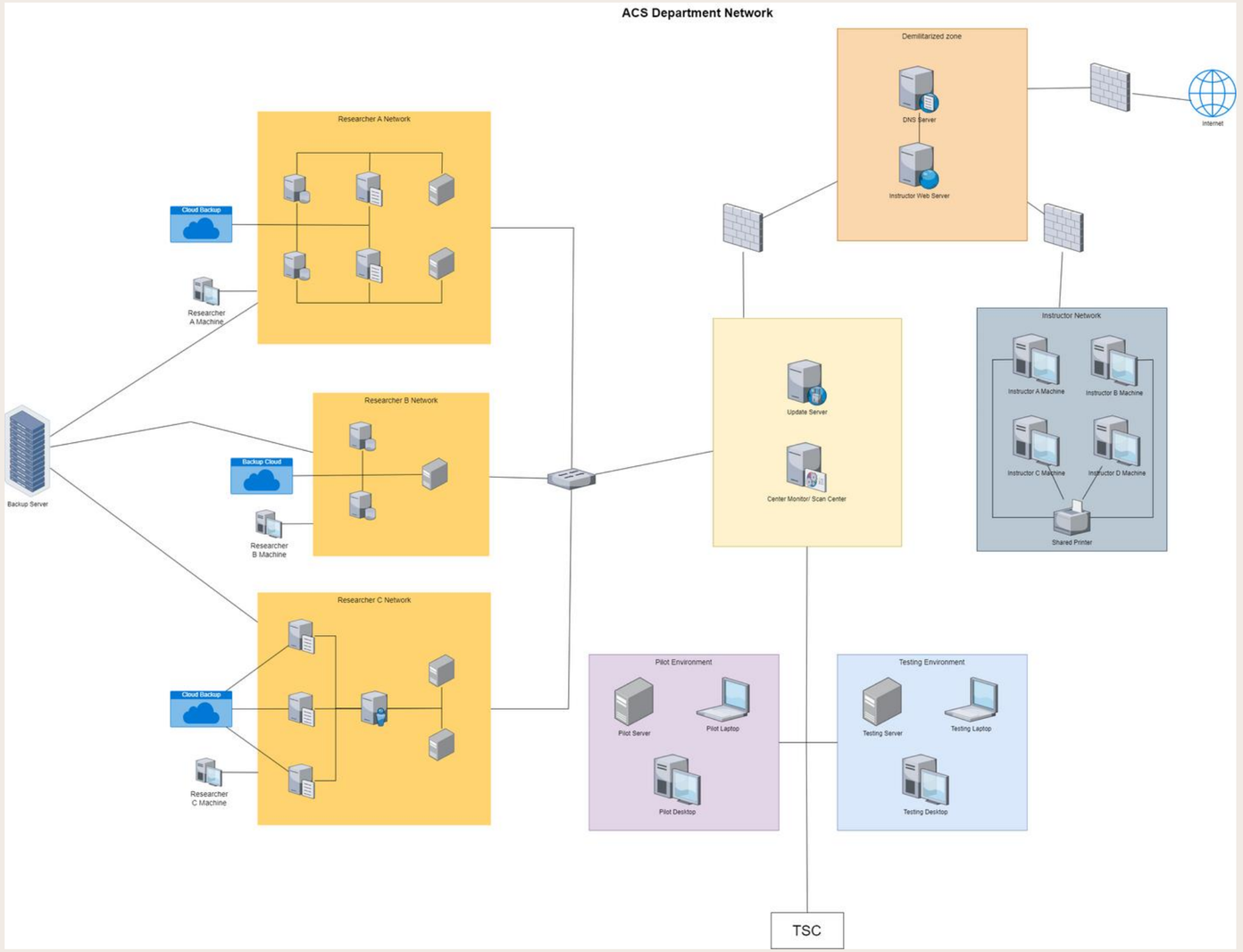
Student preferred method of contact to technician				
Student Number	Phone	Email	live call	in-person
1	2nd	1st	3rd	4th
2	1st	1st		
3				1st
4	1st	3rd		2nd
5		1st		
6			1st	
7		1st		

SOME QUANTITATIVE DATA

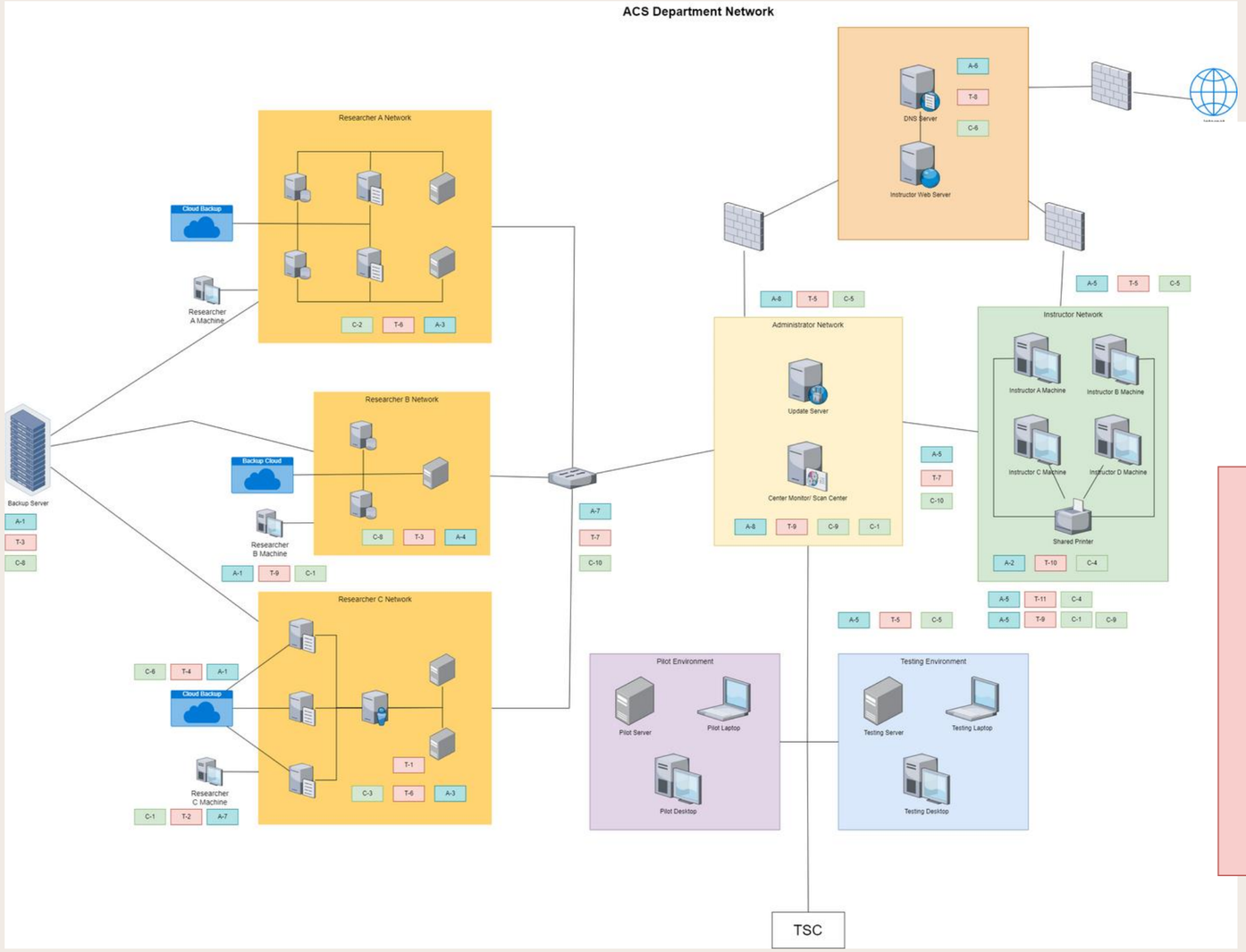
Student Attack Method Farmilairity			
Number	Attack Method	Yes	No
1	Phishing	7	
2	Spoofing	7	
3	Social engineer	7	
4	DDoS	7	
5	Malware	7	
6	SQL Injection	7	
7	Man in the middle	7	
8	DNS tunneling	3	4
9	Keystroke logging	7	
10	cross-site scripting attack	7	
11	Cryptojacking	2	5
12	Brute-force attack	7	
13	Session hijacking	7	
14	Botnet	4	3

Trust impact due to incident in student group				
Student Number	Negative	Neutral	Positive	Comment
1	1			It is worrying, of all department it is ACS, jarring Negatively impact
2	1			Not personal impact, less trust due to it
3			1	A little stress out, happy with trust At the time annoying
4		1		Not effect me personally Sure the uni will resolve it Trust 9 before, 8.5 now, can imporve
5			1	Good trust, comfortable A bit of a stress at the time
6		1		Don't even care about those email, never open them Did not hinder any study
7		1		No impact on ability to study experience Trust in uni, remind of security, aware of transmitting personal data

HIGH LEVEL NETWORK DIAGRAM



THREAT MODEL DIAGRAM



Assets

A-1 Research data

A-2 Instructor data

A-3 Researcher servers

A-4 Researcher databases

A-5 ACS machines

A-6 Instructor website

A-7 Researcher network

A-8 Administrator network

Threat Agents

T-1 Unauthorized usage of server resources

T-2 Unauthorized access to researchers' network

T-3 Unauthorized access to researcher' data

T-4 Man-in-the-Middle attack

T-5 Virus, Worms, Ransomware, etc

T-6 Exploitation of Server

T-7 Exploitation of patching mechanism

T-8 DDoS attack

T-9 Credential theft

T-10 Social engineering, phishing attack

T-11 Email spoofing, spamming

Controls

C-1 Two-factor authentication for access

C-2 Monitor network access

C-3 Monitor server operation

C-4 Email Filtering

C-5 Scanning of external packages

C-6 Endpoint security

C-7 Regular updates and patches

C-8 Strict permission model

C-9 Least privilege access

C-10 Backup and role back system

THREAT EVALUATION

LIKELIHOOD TABLE

Rating	Likelihood	Description
1	Rare	May occur only in exceptional circumstances and may be deemed as “unlucky” or very unlikely.
2	Unlikely	Could occur at some time but not expected given current controls, circumstances, and recent events.
3	Possible	Might occur at some time, but just as likely as not. It may be difficult to control its occurrence due to external influences.
4	Likely	Will probably occur in some circumstance and one should not be surprised if it occurred
5	Almost Certain	Is expected to occur in most circumstances and certainly sooner or later

THREAT EVALUATION

CONSEQUENCES TABLE

Rating	Consequence	Description
1	Insignificant	Result of a minor security breach in a single area. Limited damage that will take a day to recover.
2	Minor	Result of a minor security breach in one or two areas. Limited damage that will take 3 days to recover, does not need management intervention.
3	Moderate	Result of security breach of a sub-network. Moderate damage that needs from 1 week to 2 weeks and management intervention. The public and other users may have some knowledge of this event
4	Major	Result of security breach of multiple networks. Major damage that needs 1 month to 2 months, management intervention, and massive resources to recover. Loss of some core functionalities are expected. The public and other users will know of this event but not in detail.
5	Catastrophic	Result of complete failure of all networks and systems. Great damage that needs at least 3 months to completely recover. Management intervention is required and outside cybersecurity experts must be called in. Lawyers may be involved in legal matters relating to this event. A massive amount of resources and manpower are needed to recover. Lost all major and minor system capabilities.

THREAT EVALUATION

RISK MATRIX

Likelihood \ Consequences	Insignificant	Minor	Moderate	Major	Catastrophic
Rare	Low 1	Low 2	Low 3	Low 4	Low 5
Unlikely	Low 2	Low 4	Medium 6	Medium 8	Medium 10
Possible	Low 3	Medium 6	Medium 9	High 12	High 15
Likely	Low 4	Medium 8	High 12	High 16	Extreme 20
Almost Certain	Low 5	High 10	High 15	Extreme 20	Extreme 25

THREAT EVALUATION

RISK LEVEL TABLE

Risk Level	Description
Extreme (25-18)	Require detailed research and management planning from executive level. Constant planning and monitoring with regular reviews. The cost of managing risk is higher than projected.
High (18-12)	Require management knowledge but can be conducted by team manager. Constant planning and monitoring with regular reviews. The cost of managing risk is within the projected amount.
Medium (12-6)	Can be managed by existing monitoring and response procedures. The team can implement measures without management involvement to control risk.
Low (<6)	Can be managed through routine procedures

THREAT EVALUATION

RISK REGISTRY

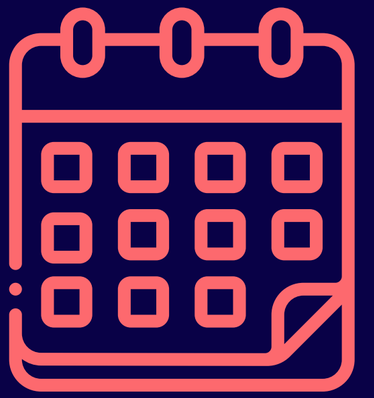
Asset	Threat	Likelihood	Consequences	Risk level	Risk Priority
Update Server	Exploitation of patching mechanism	Rare	Catastrophic	Low (5)	8
Instructor Web Server	DDoS attack	Possible	Insignificant	Low (3)	14
Instructor Machine	Phishing attack	Almost Certain	Minor	Medium (10)	1
Instructor network	Unauthorized access	Possible	Moderate	Medium (9)	3
Research network	Unauthorized access	Possible	Minor	Medium (6)	5
administrator network	Unauthorized access	Rare	Major	Low (4)	10
Researcher Database	Man-in-the-middle attack	Unlikely	Moderate	Medium (6)	6
Researcher server	Botnet	Unlikely	Moderate	Medium (6)	7
Instructor network	Virus, worms, ransomware, and other malware	Unlikely	Major	Medium (8)	4
Pilot/Testing environment	Virus, worms, ransomware, and other malware	Possible	Insignificant	Low (3)	15
Administrator network	Virus, worms, ransomware, and other malware	Rare	Major	Low (4)	11
Instructor Machine	Email spoofing	Almost Certain	Insignificant	Low (5)	9
Researcher server	Cryptojack	Rare	Moderate	Medium (9)	2
Instructor web server	Cross-site scripting attack	Unlikely	Minor	Low (4)	12
DNS server	DNS tunneling on DNS server	Unlikely	Minor	Low (4)	13

IDENTIFIED VULNERABILITIES AND RISKS

PHYSICAL SECURITY

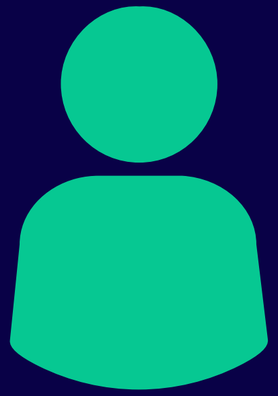
RESOURCE CONSTRAINT

ADVANDED PERSISTANT THREAT

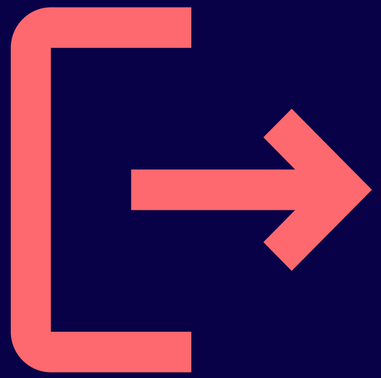


ZERO-DAY VUNERBILITIES

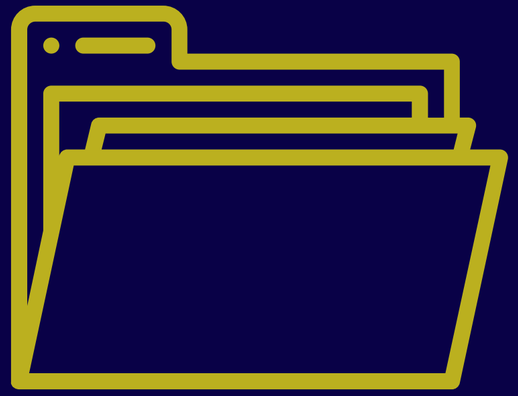
IDENTIFIED VULNERABILITIES AND RISKS



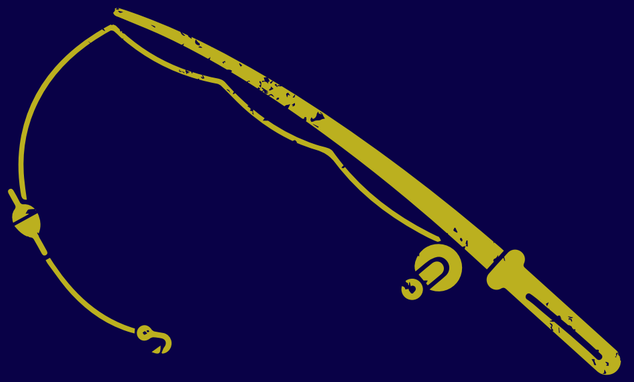
INSIDER THREAT



OUTSIDE THREAT



FILELESS MALWARE



PHISHING ATTACK

IDENTIFIED VULNERABILITIES AND RISKS

POLICIE
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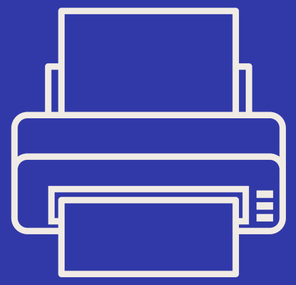
UPDATE PROCESS

ACCESS AND PRIVILEGE CONTROL

COMMUNICATION

RECOMMENDATIONS



MOVE SHARED PRINTER

FINGER-PRINT LOCKS

HIRE MORE PERSONNEL

NO EDUROAM

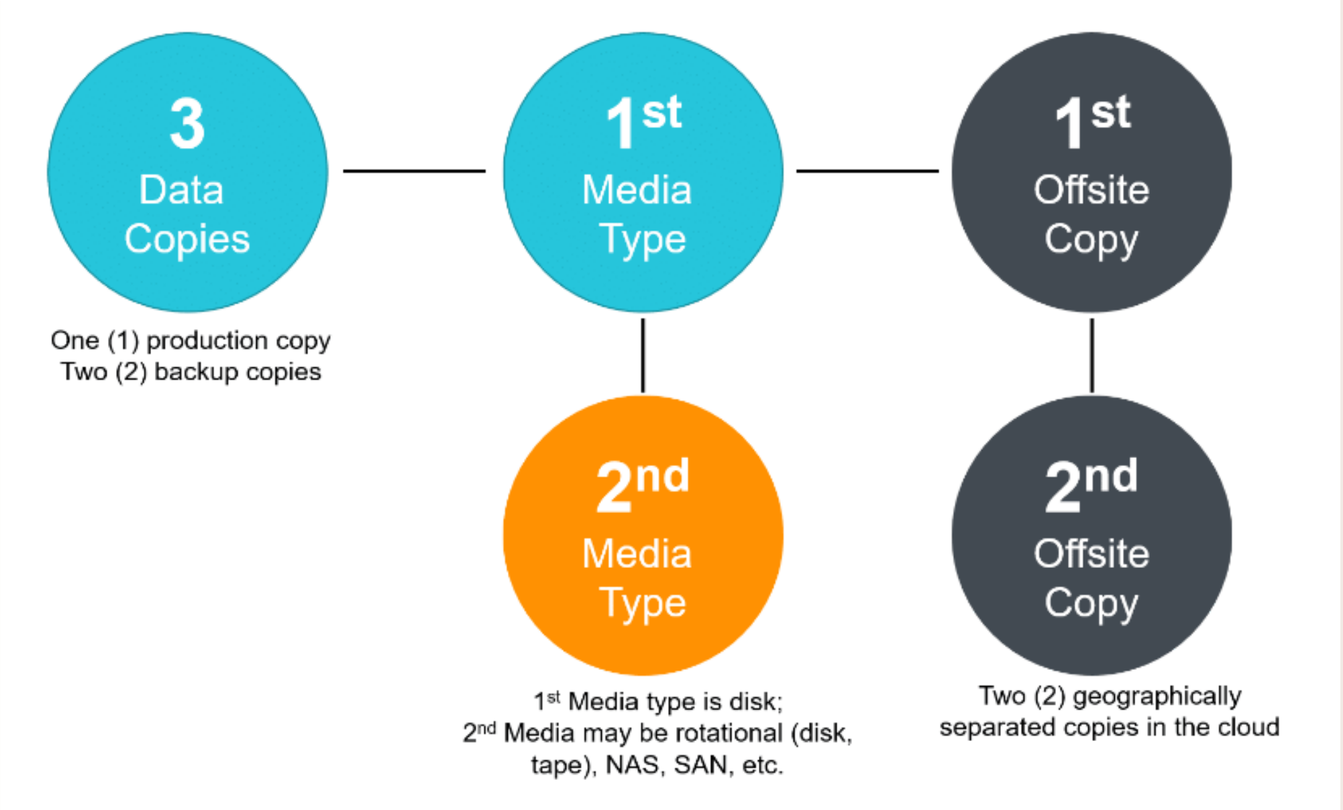
LIMITED INTERNET

VIRTUAL MACHINE

PHISHING AWARENESS

RECOMMENDATIONS

3-2-2 BACKUP SYSTEM



RECOMMENDATIONS

INCIDENT RESPONSE PLAN

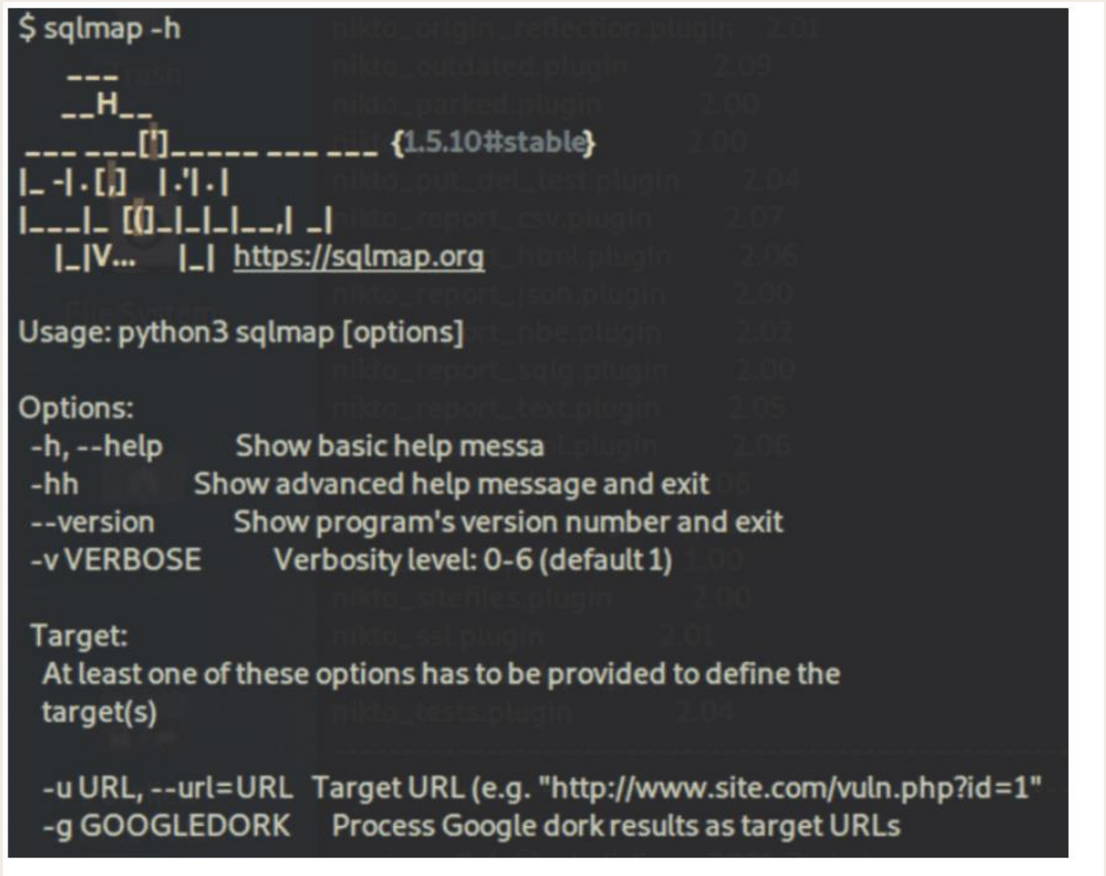
1. Inform the department chair and TSC cybersecurity team about the incident

2. Compile as much relevant information as possible while waiting for a response from the Technology Solution Center cybersecurity team

3. Limit spread of damage, if multiple systems compromised then isolate affected network

RECOMMENDATIONS

PENETRATION TESTING TOOL



THANK YOU FOR LISTENING
ANY QUESTIONS? ASK AWAY

PRESENTED BY VI LE