Introduction to Information Security and Cybersecurity

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INTRODUCTION TO INFORMATION SECURITY AND CYBERSECURITY

1. Background

i. Sensitive Data

‘Sensitive Data’ refers to information that could cause problems for the organisation that is managing it, if it should be compromised in some way.

‘Managing data’ might mean using it for normal business activities, storing it or processing it on behalf of another organisation. ‘Compromise’ of Sensitive Data means a failure of Information Security of the data, as defined in the following sub-section.

Due to the high profile of data protection regulations like GDPR, Sensitive Data is widely believed to refer only or largely to Personal Data that might be used to identify an individual. However, Sensitive Data also includes:

- Intellectual Property/Trade Secrets (commercially valuable information that is known only to a limited number of people – for example corporate strategy or financial accounts)

- Official Secrets (information that is important for national security)

- Industrial Control System data flows that are used for monitoring and management of processes in industry, energy and transportation.

- Private keys, authorisation tokens and other pieces of information that underlie cryptographic activity, for example around cryptocurrency transactions.

Obligations regarding Personal Data are mainly due to data privacy regulations (GDPR, CCPA etc.) and most larger organisations base their data protection policies – if they have any - on GDPR. This is partly because they are normally exposed to EU or UK data in one way or another, but also because non-European data privacy legislation (for example, in China and S. America) is nearly always very similar to GDPR.

Other types of sensitive data are protected by legislation such as the UK Official Secrets Acts (1911-1989), industry standards, bilateral contracts like Data Protection Agreements and NDAs etc.

ii. Information Security

‘Information Security’ refers to the protection of Sensitive Data from three main types of compromise: Failure of:

- **CONFIDENTIALITY** (unauthorised access to data)
- **INTEGRITY** (unauthorised modification or deletion of data)
- **AVAILABILITY** (users can't access data normally)

iii. Cybersecurity vs Information Security

Information Security refers to protection of Sensitive Data against the above types of compromise regardless of the form of the compromise (i.e., not necessarily just electronic 'cyber' compromise). For example, if paper documents containing Personal Data are damaged due to flooding, then that's an integrity compromise like any other. Equally, if trade secrets are revealed because someone talks about them loudly in a restaurant, then that's a confidentiality compromise as surely as if they'd been stolen by a hacker.

Cybersecurity is about IT hardware, software and data in electronic form and is a subset of Information Security, albeit one that has almost filled the entire space of Information Security, as organisations have shifted storage and processing of data to computers.

However, non-cyber aspects of Information Security remain important, in particular:

>> Human resources (HR) security
>> Behavioural security around remote working
>> Physical security (doors/keys, fire protection, CCTV etc.)
>> Compliance with legal, regulatory and contractual requirements
>> Project and change management
>> Business Continuity and Disaster Recovery

If HR security is weak (people in sensitive roles aren't properly screened, security responsibilities aren't covered in employment contracts, etc.) then many measures that are typically deployed to protect Sensitive Data are rendered ineffective or less effective, as employees ('insiders') are often able to evade them much more easily than outsiders.

Information Security may be compromised not only due to malicious activity by an external adversary (e.g., a ransomware group), but also as a result of misconduct or negligence by an insider. The concept of the 'insider threat' is one that people tend not to like much, but it is a real one that should be an important consideration in any organisation's approach to Information Security.

Sensitive Data can of course also be disrupted by natural events; fire, flooding, earthquakes etc.

2. Threats – who or what is the enemy?

i. External Adversaries

- **Ransomware gangs**
  The groups that attack organisations with ransomware malware. This type of attacker is the one that most businesses worry about, rightly.

- **Financial fraud gangs**
  Similar to the ransomware gangs but focused on financial fraud - sophisticated BEC (Business Email Compromise) scams that can result in a large, unauthorised transfer of money out of the victim organisation, which can be almost impossible to retrieve.

- **Advanced Persistent Threat (APT) groups**
  Coordinated teams of highly trained, experienced hackers that are supported by nation states. Normally the link between the hacking group and the nation state that sponsors it is intentionally blurry in order to avoid attribution.

  These are the most sophisticated and well-resourced adversaries. They undertake espionage operations and attacks on critical infrastructure, and in some cases (particularly N Korea) they are self-financing via cryptocurrency hacks.

  Many countries have officially-recognised elements of their armed forces and intelligence that conduct cyberoperations, but these are mainly focused on defensive activity. Aggressive cyber activity is normally done by APT groups – especially if it's legally questionable.

  Do most organisations have to worry about APT groups? Not really.

- **Hacktivists**
  Politically motivated hacking groups.

- **Opportunists and loaners**
  Old-style hackers. They tend to use unsophisticated techniques and hacking tools that they purchase online to disrupt businesses or steal money from them and their customers.

ii. Insiders

Employees and other insiders are a problem for Information Security because of the access that they have to sensitive data. That power can be turned against the business if they become unhappy, or are careless, poorly trained or corrupt.

They might:

- Delete or modify data by mistake
- Steal data and exfiltrate it by email/upload to cloud storage/IM/USB key/printing/photo with mobile phone/memorisation…
- Intentionally or unintentionally giving access to an attacker (click on link in email/reveal password/respond to bribery…)
- Damage hardware

iii. Natural Events

Data are frequently disrupted by natural events that cause damage to buildings, hardware, communications channels etc.

3. Threats – how is Information Security compromised?

i. Sophisticated, multi-vector attacks.

This type of attack is exemplified by ransomware; in order to carry it out you need a group of people that have a high level of hacking expertise. Contributory elements to the attack are likely to include a reconnaissance phase, development of tailored malware and other stages of what is known as the 'cyber kill chain' – described in a later section of this document.

- **RANSOMWARE**

  Ransomware attacks are about coercing the target organisation ('victim') to give money to the ransomware group, normally following something similar to these steps:

  1. Break into the victim's device(s), IT network and/or data storage (perhaps in the cloud)
  2. Find and then encrypt the victim's sensitive data where it is currently being stored, using a private encryption key that's unknown to the victim.
  3. Notify the victim about what's happened, telling them that they must pay a cryptocurrency ransom to some anonymous account

  Variations on this theme include:
    - Actually stealing data by exfiltrating a copy of it and deleting the victim's copy
    - Threatening to publish sensitive data
    - Adding extra pressure by attacking the victim's website with DDoS attack, threatening to inform shareholders and customers, etc. ('double extortion')
    - Attacking backups of data so that the victim can't restore encrypted or deleted files

- **BUSINESS EMAIL COMPROMISE (BEC)**

  The attacking group develops (fake) relationships with key staff in the victim's organisation using social media and emails that appear genuine but are in fact created using hacking tools and techniques. Targeted employees might be treasury staff and senior employees like the Finance Director, CFO or CEO.

  Once they've established trust and done all their groundwork, they carry out their attack. This is normally done by sending an email to a treasury operative in the name of the CEO or CFO, instructing a large bank transfer. The email will pile on the pressure, often be sent at a time that is close to the close of business, and be supported by phone calls and text messages.

- **ESPIONAGE**

  Theft of sensitive data; similar to the initial stages of a ransomware attack but targeting critical infrastructure operators, government bodies etc. and done by APT groups using sophisticated tools and methods.

- **ATTACKS ON CRITICAL INFRASTRUCTURE**

  The corporate IT network and assets are infiltrated by the attacker, who then proceeds to move from that network to the OT (Operational Technology) network. This is where ICS (Industrial Control System) and SCADA technologies are managed; once a skilled adversary has gained access to these, they are in a position where they are able to trigger failures in the supported processes. Gas networks, refineries, water treatment works, steel production facilities and so on can be disrupted and even permanently damaged in this way.

ii. Unsophisticated attacks

Isolated, straightforward attacks that require little to medium expertise. In some cases they can be implemented by someone with no cybersecurity knowledge whatsoever, that simply purchases the attack from some other hacker on the dark web "Crime as a Service/CaaS". Just because they are unsophisticated doesn't mean that they can't do serious damage, or cause the loss of very large sums of money.

- **ATTACKS ON WEB APPLICATIONS**

  The attacker exploits vulnerabilities in a sensitive web application such as a banking site, crypto exchange or gaming platform. By doing this, they may be able to take over customer accounts, access the back end of the web application (where information such as private keys may be stored) or compromise data in other ways.

- **DENIAL OF SERVICE (DOS) ATTACKS**

  The attacker sends so much data or requests to an IT resource such as a server, network or web application that it cannot cope and fails to operate normally. This can cause compromise of availability of data, for example by preventing banking customers from accessing their accounts.

  DoS attacks are normally carried out by a coordinated group of infected computers (a BotNet), in which case they are called Distributed Denial of Service (DDoS) attacks.

iii. Insider threats

- The scope of malicious attacks by insiders is limited only by what access the insider has (not only in terms of information that they can view, but whether they have rights to copy or modify data). Clearly insiders also have access to hardware, so they can steal or deliberately damage desktop computers, laptops, routers, printers…

- Insiders can also cause compromise of Sensitive Data due to negligence and in fact this is more frequent than intentional theft or disruption.

  That might mean:

  - Negligently revealing access credentials (user name, password) or other Sensitive Data – for example by allowing someone to see their laptop screen in an airport lounge.
  - Losing hardware or failing to protect it properly, so that it gets stolen
  - Sending sensitive data by email to the wrong person by mistake
  - Misconfiguring software and particularly cloud storage services
  - Deleting files by mistake

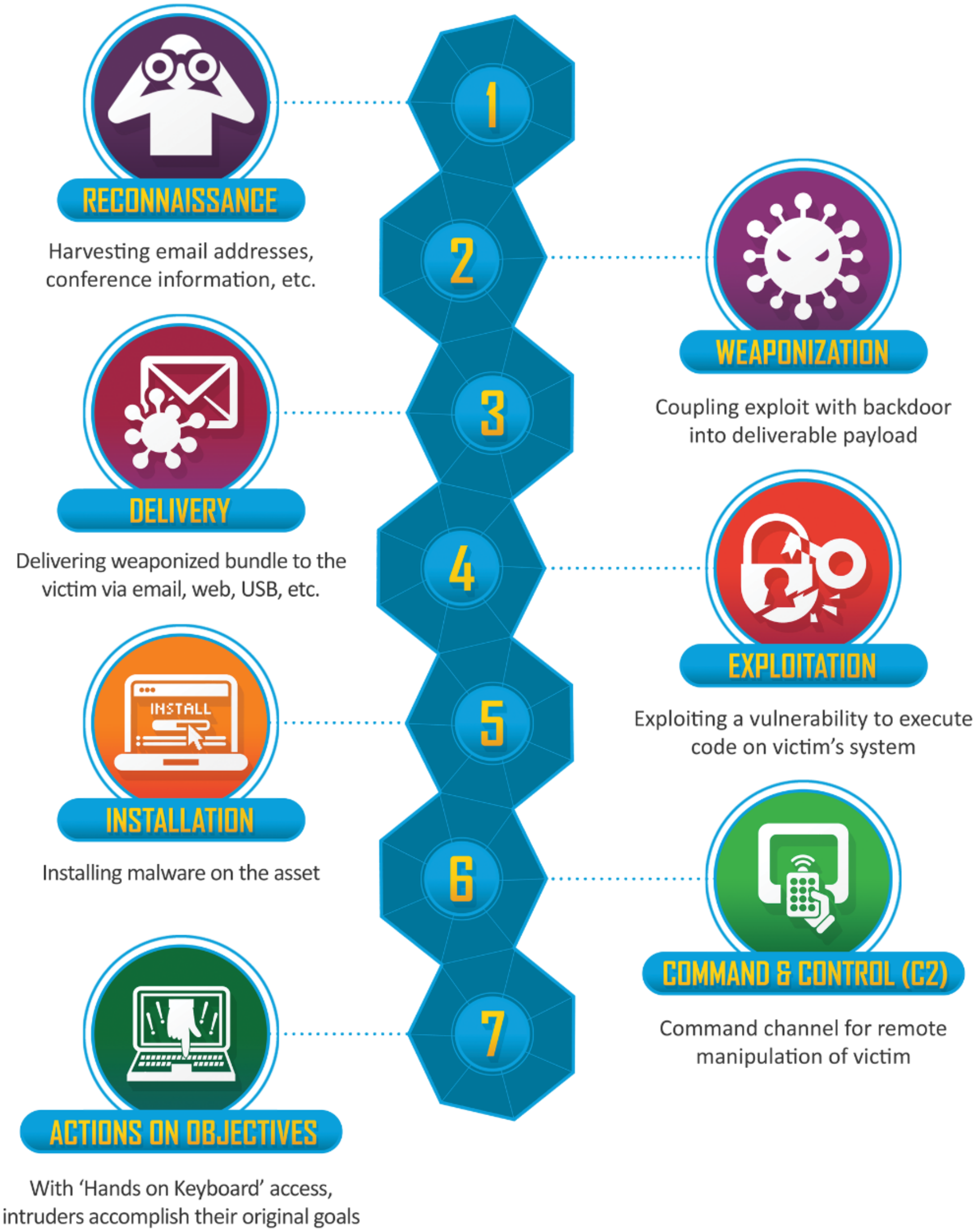
iv. Risks from natural events

'Natural events' refer to fires, floods, earthquakes, hurricanes and other phenomena that are normally outside human control. Mice chewing through cables is genuinely a potential risk that needs to be managed.

If an organisation is exposed to these types of risks, then potential impact on Information Security includes what might result from damage to:

- hardware that is used to store or process Sensitive Data
- hardware that is used to support transmission of Sensitive Data (routers, cables..)
- utility infrastructure, particularly electricity and internet
- transportation and buildings (preventing employees to get to work or to work normally)
- data centres

Risks of this type are largely mitigated by the business continuity/disaster recovery plan, which in turn leans on redundancy and failover for critical assets and services.


1
RECONNAISSANCE
Harvesting email addresses, conference information, etc.
2
WEAPONIZATION
Coupling exploit with backdoor into deliverable payload
3
DELIVERY
Delivering weaponized bundle to the victim via email, web, USB, etc.
4
EXPLOITATION
Exploiting a vulnerability to execute code on victim's system
5
INSTALL
INSTALLATION
Installing malware on the asset
6
COMMAND & CONTROL (C2)
Command channel for remote manipulation of victim
7
ACTIONS ON OBJECTIVES
With 'Hands on Keyboard' access, intruders accomplish their original goals

Infographic: Cyber Kill Chain (developed by Lockheed Martin)

4. Carrying out a cyber attack

i. The Cyber Kill Chain

Most sophisticated attacks follow the following steps:

1. Reconnaissance (find out about the target organisation using software and old-fashioned social engineering)
2. Weaponization (build appropriate malware 'virus' package)
3. ***Delivery*** (get the payload into the victim's device and network)
4. Exploitation (trigger the malware within a device)
5. Installation (install a backdoor within the victim's network)
6. Command & control (malware opens up communications with an external server)
7. Actions on objective (look for sensitive data and encrypt, delete and/or exfiltrate it, or whatever other aims the attacker might have)

Note that:

- An attack can be caused to fail by disrupting it at any step of the cyber kill chain
- Cybersecurity solutions (technical or procedural measures used to mitigate cybersecurity risks) tend to focus on doing exactly that (email security, file scanning, detection of suspicious network activity, detection of attempts to send data out of the network etc.)
- The Delivery phase is a particularly important and vulnerable step of the chain. If employees can be trained to spot phishing emails, then many attacks can be prevented at this stage.

ii. Attack Vector

The Attack Vector (AV) is the method used to insert malware into the victim's network during the Delivery step - a very vulnerable phase for the attacker.

Even highly sophisticated attacks tend to use a phishing email as the AV in the Delivery phase of the kill chain. For some reason, that aspect of hacking has not evolved much in recent years, although the quality of phishing mails has definitely improved.

Phishing emails and text messages look bona fide. For example, they might look like genuine messages requesting personal information from Amazon or Parcelforce. However, the attachment or website link that they contain trigger a download of malware onto the user's device.

Alternative AV's include attacks that leverage security misconfigurations and vulnerabilities in web applications.

iii. Malware

“Malware” = Malicious Software. Once installed in a device it carries out some or all of steps 5-7 in the cyber kill chain. These might include:

- Logging keyboard activity (e.g., for passwords, credit card credentials)
- Searching around the network for sensitive data
- Exfiltrating/encrypting/deleting data, or some combination of these.
- Establishing communications with an external server, which can provide instructions or install additional malware
- Taking partial control of the device in order to do unauthorised crypto mining or participating in a DDoS attack

iv. Vulnerabilities

All operating systems, software, firmware and devices have some kind of vulnerability or vulnerabilities in them that can be exploited. That means a weakness that an attacker can take advantage of in order to access the asset or do other unauthorised activity. We may not know about them yet, but they’re there – nothing is perfect! It’s just a matter of how long it takes for an adversary to find them.

Once a vulnerability is discovered by – or communicated to – the organisation that is responsible for it, then that organisation will normally issue a security update/patch. For example, every time that Apple releases an OS update for iPhones, iPads and Macs, it contains security updates to patch found vulnerabilities.

Meanwhile, attackers start looking for and exploiting found vulnerabilities straight away, and also share details about them with other hackers using the dark web.

It is often possible for adversaries to scan the internet for exposed devices that are using software/firmware versions that are out of date and vulnerable to recently discovered exploits (for example early versions of Windows OS).

Organisations can enrol in ‘bug bounty’ programs whereby they commit to making cash payments to ethical (‘good guy’) hackers that spot vulnerabilities and other coding errors (‘bugs’) and notify them. This is definitely recommended.

v. Zero Days

When a type of malware is created that has never been seen before, it can be hard for cybersecurity solutions to manage. This is because most anti-malware software is based around a library of signatures of malware instances that have been spotted and documented. Probably around 99% or more malware is in the documented category – the remaining 1% tends to slip through standard protective software.

Zero-day malware can sometimes be detected by software that uses techniques such as sandboxing (launching or 'detonating' suspicious files in a controlled environment to see what they do) and machine-learning approaches that look for very subtle signs that a file may be malicious.

Vulnerabilities that have just been discovered, and for which a security update has not yet been released are also described as zero days. They are also a major problem: Attackers that become aware of them will use them as quickly as possible against their most attractive targets, and try successfully to exploit them before victims can roll out security updates. This is why security updates should always be deployed ASAP.

vi. Misconfiguration of security settings

This occurs when the victim fails appropriately to configure the security settings of exposed resources. For example, they might set up a cloud storage resource containing sensitive data such that it can be viewed publicly with no password requirement. This happens surprisingly frequently.

Misconfigurations of this type can often be detected by scanning software and specialised search engines. They are an inexcusable reason to be hacked.

vii. Password or login attacks on web applications

An important family of attacks on web applications leans on vulnerabilities around passwords and logins. These vulnerabilities might be in the web app itself, or due to users managing their passwords badly.

POOR PASSWORD MANAGEMENT BY USERS

Users can expose themselves to unnecessary risk by failing to choose and manage passwords correctly, in two main ways:

- Choice of passwords that are too short, insufficiently complex and too easy to guess (e.g., 'password', 'robin123', aaaaaa etc.)
- Using the same passwords in different places (for example, same password for Gmail, Amazon, LinkedIn, Zoom etc.

TYPES OF ATTACK ON LOGINS AND PASSWORDS

Brute Force Attack; Dictionary Attack
In both of these attacks, the adversary attempts to guess the user's password by trying all or many of the different possible ones. This might be billions, trillions or more permutations of letters, numbers and special characters.

In a brute force attack, the attacker works through all different possible permutations including completely random selections. Dictionary Attacks use popular known passwords, names and real words, so they can often crack the password much more quickly than pure brute force.

Passwords are more resistant to these attacks if they are longer, use a combination of letters, numbers and special characters (like $, &, @) and are random selections rather than real words or names.

Credential Stuffing Attack
From time to time, attackers successfully hack an organisation and steal the database of usernames along with their associated passwords. Once they have these, then that organisation's user accounts are obviously vulnerable.

However, the attacker is also able to take advantage of the fact that users often use the same passwords in different locations. They do that by testing these found username/password combinations on other web applications; when an organisation is severely breached, affected users often find that accounts that they hold elsewhere are also attacked.

This risk is mitigated by users being careful not to use the same password for different applications – best achieved by using a password manager.

MULTI-FACTOR AUTHENTICATION (MFA)

Most password/login attacks can be mitigated by the use of 2FA (two factor authentication) aka MFA. This is described in a following section.

5. The dark web and cybersecurity

The dark web is used by a number of different participants of the cybersecurity ecosystem, and does need to be taken into consideration as part of overall information security. This is because it is contains forums and market places for display of and trade in:

- **Data that's been stolen in ransomware attacks**
  Ransomware gangs often display stolen data on forums and specialised websites, to prove that they have been able successfully to hack their victims, and to put pressure on them.

- **Stolen information that might be used by attackers**
  Stolen usernames, credit card credentials and other sensitive data often turn up on dark web forums and market places. That might be the first sign that your business has been hacked, and a warning that it's time to change passwords!

- **Cybersecurity goods and services**
  Malware and found vulnerabilities including expensive zero-days are available for sale on the dark web. That means that cybersecurity threat researchers and law enforcement operatives spend a lot of time looking at what's available there, and trying to work out who's selling it!

Law-abiding organisations make use of software and service suppliers that monitor the dark web, looking for information that may be relevant for them.

6. Defensive concepts in information security and cybersecurity, that your business can lean on

The attack surface

This is the totality of all the different points via which an adversary might be able to access your organisation's sensitive data. This includes:

- Devices
- Websites and apps
- Corporate WiFi access points
- IoT devices (connected CCTV, HVAC etc.)
- Employees
- Suppliers and SaaS with access to data
- etc. etc…

One primary objective of any information security plan is rigorously to map out the organisation's attack surface. In ISO27001 this is done by creating an Asset Inventory which lists out assets that are related to information security, and assigns an owner to each of them.

"An organisation's Information Security is as strong as the weakest point on its attack surface".

A small attack surface is more secure than a large one, but there is a trade-off between attack surface size and freedom of information flow that may cause problems for some organisations.

Once the attack surface is well understood, it should be gap tested for risk-assessed protection on all its points and any failures remediated.

Defence in depth

This is a defensive strategy that was developed in medieval times and is now used – in adapted form - in information security.

The basic concept is that multiple layers of security are much harder to penetrate than a single layer, rather like a medieval fortress with a moat, outer walls, keep etc. In information security this is expressed by deployment a series of layers of defensive measures, e.g.,

>> Employees are screened and given security awareness training
>> Emails are scanned by a software solution
>> Anti-malware software is installed on computers
>> Sensitive data are encrypted and securely backed up

To quite a great extent, defence in depth responds to the cyber kill chain representation of a typical sophisticated cyberattack.

- ## Zero trust

The zero trust approach to cybersecurity has arisen largely due to the change in typical corporate network architecture that has happened in the last ten years or so. This, in turn, has been driven by a shift of data and applications to the cloud, and the prevalence of remote working:

"Traditional" architecture	"New "architecture
Data stored on server(s) in the office	Data stored in the cloud
Applications operate within the perimeter	Applications regularly cross back and forth over the perimeter
Users normally work in the office	Users work all over the place
Users VPN into servers	Users connect to cloud services over the internet
Applications, data and users in an organisation mainly communicate within the same country	Organisations often regularly see communications and data flows that are between countries and even intercontinental
Sufficient to apply most security at the perimeter (network firewall)	Network firewalls don't make any sense anymore and users and applications must be authenticated wherever they may be

The Zero Trust approach to security (Zero Trust Architecture) engages with the "new" Cloud/Remote Working architecture, and ideally combines the following features:

- Continuous verification and authentication of 'agents' - human users or applications - using multiple attributes that might include user identity and credentials, geolocation, device type, patching level, time etc.
- Minimum required access, provided only when its needed
- Secure encryption everywhere!
- Verification of software and hardware
- Continuous monitoring of log data
- Network segregation to prevent adversaries moving around

Several software solutions have been developed that can enable businesses to implement some kind of zero trust approach.

- **Multi-factor authentication (MFA)**

Traditionally, authentication and access control into devices and applications has been via a login process that uses one 'factor'. A factor is something that only the correct user should have access to – for example, a password/PIN, card, fingerprint. We have seen that passwords are quite vulnerable but this can also be the case for physical keys (which can be lost or stolen) and other single factors. By using two factors rather than one, the level of security can be very substantially enhanced.

Most people are familiar with MFA nowadays (typically implemented as 2FA, with just one additional factor). The most popular second factor is currently an OTP (one time password) that is sent by SMS or email, or generated by an authenticator app.

MFA is becoming a requirement for the protection of sensitive data, as single-factor authentication using passwords is now so frequently abused.

- **Threat intelligence**

This is about staying on top of the latest threats, risks and trends in cybersecurity. Organisations are recommended to make certain employees (typically the Information Security Officer) responsible for subscribing to reporting services that provides updates about information security, cybersecurity and data privacy regulations. Other suggested sources include a range of websites, Twitter, LinkedIn and so on.

These responsible individuals screen, sift and share relevant information that they have picked up with other employees, in a way that may be formalised (weekly newsletter, **Read immediately** type emails).

7. Information Security Standards and Frameworks

Given how many aspects there are to Information Security and cybersecurity that apparently need to be addressed, you may well ask how an organisation can verify that it has an approach in place that is rigorous, complete and effective. Secondly, how can it provide evidence of this to third-parties that are looking to do business with them or invest in them?

A good response to both of these questions is to get a certification or attestation to a recognised and respected security framework.

The main ones are ISO27001, SOC2 and NIST CSF. An increasing number of organisations – particularly government/council, finance and critical infrastructure, although the list is growing – require suppliers that access their sensitive information to have one of these.

The process to obtain one is roughly as follows:

1. Conduct a gap analysis of the organisation's level of information security in all areas of the certification, vs the requirements of the certification
2. Conduct a risk assessment based on the above
3. Do whatever is required to meet the certification requirements based on the gap analysis and risk assessment (write up documentation, establish processes and procedures, assign roles or hire staff, purchase software etc.)
4. Conduct an internal audit to verify that conditions have been met
5. Either get certification audit done (ISO27001) or write attestation (SOC2)

Depending on the size of the organisation, it can take between about four months and a year to achieve ISO27001 certification. Then it must be recertified on an annual basis. It's quite a lot of work.

8. HR security

Human resources security is such an important part of information security that it gets its own section here. HR security means a lot more than screening – here are the main components of HR security:

- Screen employees (DBS check, CV verification, references)
- Ensure that Information Security is properly covered in the Employment Contract and Employee Handbook, including correctly worded confidentiality clause/NDA
- Ensure that employees receive regular security awareness training and keep a record of their performance
- Do other training/education (GDPR, secure development…)
- Have in place a disciplinary procedure process; it should include definition of negligence, misconduct around information security responsibilities
- Follow onboarding/offboarding procedures for new starters and leavers

9. Secure Development

Organisations that develop software that is exposed over the internet (largely, web applications) need to be very careful that the software is written and built securely: Attackers have 24 hours/day, 7 days/week available for scanning and investigation of websites to look for exploitable flaws, and they use this time productively.

Core aspects of Secure Development include:

- Having a policy in place regarding secure development
- Following a Secure Software Development Lifecycle (SSDLC)

    - Establishing software engineering principles that must be applied by developers
    - Ensuring security of development environments by using appropriate access control policies and technical measures
    - Using software to:
        - Analyse open source components and container images
        - Do static analysis of written code to check for vulnerabilities
        - Check licensing conditions of open source components

10. Business Continuity, Disaster Recovery and Incident Response

These practices and procedures are highly relevant to Information Security, and Information Security is relevant to them.

Approaches to Business Continuity and Disaster Recovery have changed considerably now that so many more employees work remotely – or can easily do so if necessary. For example, nowadays organisations tend to worry less about physical disruption (natural disasters, fires etc.) and more about appropriate configuration of cloud services in terms of backups and redundancy. Critical SaaS providers are also in the spotlight: How are *their* BC/DR plans? Are alternatives available if one goes down?

Business Continuity
The practice of maintaining normal business operations if some kind of disruptive event occurs. The relevance to Information Security is largely due to the risks of compromise of availability and integrity of Sensitive Data for clients, employees and third parties.

It's also critically important that Information Security of data is maintained despite adverse circumstances that might include employees being forced to work remotely, fewer senior employees being available, failure of certain communications channels, loss of critical suppliers and so on.

Incident Response
How the business reacts to a compromise or potential compromise of Sensitive Data, such as a ransomware attack or theft of data by an employee. The quality of the response by employees may determine whether or not the business survives a major incident.

Disaster Recovery
Getting the organisation back to BAU status as soon as possible. This is largely around familiarity with the procedures to return assets and services to normal operation, but also failovers/fallbacks and how to get them up and running.

11. Data protection regulations, for Personal Data

Here's a brief summary of the main requirements of GDPR; most national or state-level data protection legislation is modelled to quite a great extent on GDPR, and

GDPR is directly relevant to a lot of organisations anyway, due to the fact that so many businesses control or process at least some data that is associated with EU or UK nationals.

*'**Personal Data**' means any information relating to an identified or identifiable natural person ('data subject'); an identifiable natural person is one who can be identified, directly or indirectly, in particular by reference to an identifier such as a name, an identification number, location data, an online identifier or to one or more factors specific to the physical, physiological, genetic, mental, economic, cultural or social identity of that natural person.*

*'**Processing**' means any operation or set of operations which is performed on personal data or on sets of personal data, whether or not by automated means, such as collection, recording, organisation, structuring, storage, adaptation or alteration, retrieval, consultation, use, disclosure by transmission, dissemination or otherwise making available, alignment or combination, restriction, erasure or destruction.*

*'**Controller**' means the natural or legal person, public authority, agency or other body which, alone or jointly with others, determines the purposes and means of the processing of personal data; where the purposes and means of such processing are determined by Union or Member State law, the controller or the specific criteria for its nomination may be provided for by Union or Member State law*

*'**Processor**' means a natural or legal person, public authority, agency or other body which processes personal data on behalf of the controller.*

- **INFORMATION SECURITY**
  Personal Data should be protected against accidental loss, destruction or damage, using appropriate technical or organisation measures.
  Confidentiality, integrity, availability and resilience of processing systems and services must be ensured.

- **DATA BREACHES**
  Subject to certain conditions, any data breach must be notified to the relevant regulatory authority within some statutory period.

- **RIGHTS OF THE SUBJECT**
  [The 'Subject' is the person that the personal data is linked to; the owner of the data]
  Personal Data should only be collected for good reason and in a transparent fashion.
  Personal Data should not be retained for any longer than necessary (data retention policy, data discovery and deletion)
  The Subject has the right to access, rectify or erase the data ('right to be forgotten')
  Subjects should normally be informed 'without undue delay' if their data has been compromised.

- **CONTROLLER AND PROCESSOR**
  The different specific obligations and requirements of Controllers and Processors of Personal Data

- **DATA TRANSFER ACROSS BORDERS**
  There are strict controls regarding Personal Data moving outside or into different jurisdictions. This is highly relevant for organisations that use cloud services that host data over multiple data centres.

- **PENALTIES THAT MAY BE INCURRED DUE TO A DATA BREACH**
  Description of the fines and other penalties that may be applicable to infringements of the regulation.

- **PRIVACY POLICY**
  There must be a publicly available Privacy Policy that shows, among other things:

  - Contact details of data controller
  - Information that is retained and why it is retained
  - How long it's retained
  - Statement regarding security measures that are in place
  - Statement regarding the subjects rights regarding access, rectification, erasure and complaints
  - Contact details of relevant regulator

12. Future information security risks (non-exhaustive, unfortunately!)

- ### Artificial Intelligence and Information Security/Cybersecurity

  There are two main areas to focus on here:

  - **AI for attack and defence**
    Adversaries are already starting to use Large Language Models (LLMs) like ChatGPT to help them with phishing campaigns, and to develop advanced malware that can evade EDR solutions.

    Organisations that are concerned about the threat from AI-enhanced phishing and malware are recommended to use very advanced EDR/XDR and SIEM solutions, or MDR. They should also stay on top of threat intelligence sources that provide information about developments in this area.

  - **Internal data breach risks**
    Many organisations have banned the use of AI/LLM applications in the workplace, as users have already started unwittingly to expose sensitive data via these apps. They are also worried about similar risks from applications that they use in their own apps that are LLM-powered, such as chatbots in web applications

- **Post-Quantum Encryption**

  Practical quantum computing is likely to become available to certain countries within five to ten years, and in fact they may already be using it, for all we know.

  One potential application of quantum computing is the breaking of several different cryptographic methods, including those that are used to encrypt/decrypt information that is transferred over the internet.

  That will obviously be a problem when quantum computing becomes available to attackers, but in fact it is already a problem now. This is because adversaries are already gathering data that was encrypted using quantum-vulnerable algorithms, with a view to decrypting the data when the technology becomes available. Relevant sensitive data obviously include Official Secrets, but also personal data that don't change over a long period (tax data, social security numbers, addresses), medical data, trade secrets, crypto wallet keys and so on.

  There is software that enables organisations to encrypt data in a way that is theoretically resistant to quantum computers.