**Year 12 Applied Information Technology Semester 1 Revision:**

**Design Concepts:**

* relationship(s) between the elements of design and the principles of design
* features of a user interface
	+ logical and hierarchical organisation of content
	+ graphical user interface (GUI) suitable for target audience
	+ relevant help features of a graphical user interface
* usability
* inclusivity
* accessibility

**Elements and Principles of Design:**

**Relationship between elements and principles**

* **Elements are techniques to create principles**
* **Principles are guidelines for a good design**

**Principles:**

Proportion:

* Proportion refers to the relationship between one part of a design and another part or to the whole design
* Comparison of sizes and shapes
* Vertical and horizontal lines on a poster or website may produce an interesting contrast

Emphasis:

* Emphasis is the quality that draws your attention to a certain part of a design first
	+ Contrasting colour
	+ Different or unusual lines
	+ Varying shape sizes
	+ Different shapes

Harmony/Unity/Proximity:

* When aspects of a design look right together, you have created unity or harmony – a coherent whole
	+ Repeating lines and shapes
	+ Curved lines with curved shapes
	+ Harmonious colours with a common hue
	+ Similar textures

Dominance:

* Dominance is the focus given to a design and helps to create unity as the eye is attracted to the key point of the design
	+ Contrasting elements such as line, shape, tone, texture, size and colour
	+ Dominance and balance works together to create unity
* Dominance plays a major role where emphasis occurs i.e. repeated elements without some form of dominance can create monotony

Pattern:

* Pattern and rhythm shows consistency with colours and/or lines
	+ Use of similar or connected elements
	+ Elements are repeated

Movement:

* Movement is motion. This can be achieved by using a graphic element that direct the eye in a certain direction such as:
	+ Arrows or lines indicating direction
	+ Series of lines and dots that gets progressively larger or smaller
	+ Use a photograph or image of something moving

**Elements:**

Colour

* Attracts attentions, affect feelings or moods and conveys messages
* Monochromatic: one colour with variations in tint, harmonious, restful, quiet

Line

* Direct a reader’s eye and separate or highlight information (organise information)
* Anything including text, images and dots can form a line
* Suggests moods and looks in a document

Space

* Gives eyes a rest
* Draw attention to certain elements of a page
* Create a focal point

Shape

* Interesting shapes attract attention
* Shapes can consist of anything including text and empty text
* Where physical shapes are not practical, create the impression of shape using colour and space

Texture

**Features of a user interface:**

User interface (UI) – the way humans interact or engage with a computing device, handheld, laptop or desktop. The point of intersection where the human meets machine. UI should have these:

* Aesthetically pleasing
* Ease of use
* Readability
* Logical order
* Inclusivity
* Navigation

User experience – thoughts, feelings and opinions of a user using and accessing a user interface

Usability: how easy it is to use

How to test usability:

* Loading times
* Time to get to a page

Quality components:

* Memorability
* Efficiency
* Learnability
* Errors
* Satisfaction

People will be able to effectively use the website with the following:

* Search function
* Site map
	+ logical organisation
* Breadcrumbs
	+ Able to backtrack, know where they were previously
* Consistency across all pages with common UI elements
	+ Colour schemes
	+ Menu layouts
* Purposeful layout
	+ Responsive design – adjust layout depending on device/screen size/browser
* Typography to create hierarchy and clarity

Inclusivity: a sense of belonging, can participate. It includes community, culture, gender, race and socio economic factors

* Language choices – text to audio
* Cultural sensitivity – currency converter
* Gender neutral or specific – neutral colours

Accessibility: allow people with and without disabilities to benefit from the same services

* Font resizable
* Alternate texts for images
* Screen readers (software that vision impaired people use to be able to ‘read’ the screen) and magnifiers
* Colour blind friendly colours ability to change
* Turn off style sheets

Navigational options:

* Buttons
* Search
* Breadcrumbs
* Sitemap
* Hypertext

How the application meets the needs of the target audience?

* Identify what/who your target audience is
	+ Gender
	+ Age
	+ Interests
	+ Income
	+ Job
	+ Background (cultural/personal/religious)
* How does your application aim to meet these needs?
	+ Is it welcoming to everyone and anyone?
	+ Can it be accessed on any device?
	+ How does it meet these needs?

Relevant help features:

* Examples of help features include:
	+ Help centres
	+ FAQs
	+ Guides to how to use features in the applications
	+ Report problems feature

What to prioritise when preparing a website for a mobile device?

* Similar experience to full site e.g. design/branding, logo, layout
* Larger UI e.g. buttons, space around button, lower resolution images, changing drop-down menus
* Organisation of content for given medium e.g. GPS location services, one touch connect/communication

**Project Management:**

* project management approaches
	+ prototype
	+ structured
* project planning tools
	+ storyboards
	+ site maps
	+ flow charts
	+ Gantt charts
	+ project management software
* appearance considerations for a digital product and/or digital solution
	+ structure
	+ usability
	+ accessibility
	+ user experience (UX)
	+ user interface (UI)

**Project Management Approaches:**

Project management is a methodical approach to planning and guiding project processes from start to finish

Structured:

Most structured project management approaches use **defined stages**;

* Initiation
* Planning and design
* Execution and construction
* Monitoring and controlling
* Completion and closing

Advantages of a structured approach:

* All stages are documented and planned carefully
* All stakeholders are included in the process
* Helps to deliver on time, within budget and to quality
* Provides a clearly defined structure with responsibilities outlined
* Defined decision points and movement between stages
* Focus on goals and deliverables

Disadvantages:

* Suited to larger projects
* Increased planning, design and documentation time
* Increase cost
* Project must be clearly defined at the start
* Not very open to change along the way, rigid
* Limited user input

**Prototype:**

Prototype Model:

* An early sample, model, or release of a product built to test a concept or process or to act as a thing to be replicated or learned from
* Early approximation of a final system or product
* It is built, tested and then reworked as necessary until an acceptable prototype is finally achieved

Benefits of prototyping:

* Better quality system delivered – sometimes a developer may not fully understand what the end user is expecting. Prototyping enables any misunderstandings to be identified and sorted out early on in the process
* Identify problems early on – a working system is available early on in the process. The user can identify possible improvements which can be made before the system is completed
* End user involvement – the end user feels more involved in the development of the system and will ‘buy’ into it
* Fulfil user requirements – a system which has been through prototyping will generally have an improved design quality and will be far closer to what the user needs
* Cost savings – it is far less expensive to rectify problems with the system in the early stages of development than towards the end of the project
* Training – the prototype can eventually be used to help train staff while the real system is still being fully developed

Problems with prototyping:

* Excessive development time- when the end user is asked to evaluate a prototype and provide feedback there is a risk that they will be forever wanting to tweak the system, thus leading to delays in development
* User confusion – users can be confused or disappointed with the final system if it differs greatly from the prototype
* Increased development time
* Too much focus on one part of the system – some aspects of the system might be neglected
* Expense of prototyping

**Project Planning Tools:**

Storyboard: A sequence of drawings, typically with some directions and dialogue, representing the shots planned for a film or television production

* Best way to share your vision
* Makes production much easier
* Saves you time

A flowchart is a type of diagram that represents an algorithm, workflow or process, showing the steps as boxes of various kinds, and their order by connecting them with arrows. This diagrammatic representation illustrates a solution model to a given problem

The Gantt Chart shows the work breakdown structure (list of tasks with duration) and the relationship between the tasks. In the example below, most tasks have a Finish-Start relationship which indicates that a task must be completed before the next related task can commence. However, tasks 4 and 5 have a Start-Start relationship as they can be done at the same time



* Concept of SLAs
* Features of SLAs including
	+ Availability of service
	+ Type of services
* Advantages of local and global outsourcing compared with in house production
* Purpose of outsourcing data management
* Evaluation of software including usability

Service level agreement:

* Contract between a service provider and the end user that defines the level of service expected from the service provider
* Developed for a business and an external service provider i.e. internet service provider (ISP), cloud storage or a provider of Networking or Mail Services such as Datacom

Features of SLA:

* Contracted delivery time, time-between-failures and time-to-recovery
* Scope (boundary) or level of support and responsibility
* Statement of intent (what each party wants from SLA)
* Durations of the agreement
* Measurable targets
* Communication plan
* Contract/agreement signatures
* To agree on services to be provided
* To outline duties of the customer
* To agree on schedule of payment
* To define the performance expected
* To outline the penalties for failure
* To state the warranties provided
* To clarify termination conditions

Types of services commonly addressed in an SLA:

* Customer service – between you and external customer e.g. help desk, online chat
* Internal service – between you and an internal customer e.g. data protection, response time
* Vendor service – between you and a vendor e.g. someone who repairs your equipment or supports your IT; guarantee of uptime, hosting

Availability of service:

* Reference to an actual SLA and one or both
	+ The service is accessible for a period of time
	+ A high quality of service is provided

Advantages of local and global outsourcing compared with in-house production:

* Outsourcing – contracting or subcontracting of noncore activities to free up cash, personnel, time, and facilities for activities in which a company holds competitive advantage

In house vs outsourcing:

* In house operation is an activity performed within the same business, using the company’s assets and employees to perform the necessary tasks, whereas outsourcing involves hiring outside assistance, often through another business, to perform those activities instead of using internal assets or employees

Advantages of outsourcing:

* Staff are free to work on core tasks rather than tasks to be outsourced
* Lower costs of recruitment and training
* Specialist work can be outsourced, saving time and money
* Shared risk
* Pay only for what you use
* Ease of scalability

Disadvantages of outsourcing:

* Potential for private and confidential data to be lost or released
* Different customer expectations and service from business to contractors
* Service level agreements must be put in place and maintained
* Time, budget and resources still need to be managed carefully
* Some control of processes and production lost

**Hardware:**

* specifications of digital devices and their impact upon usability
* characteristics of development trends in emerging mobile devices
* suitability of emerging mobile devices to meet client (user) needs
* usability of digital devices for specified client requirements

**Components of a computer:**

**Computer:**A **computer** is an electronic device, operating under the control of instructions stored in its own memory, that can accept data, process the data according to specified rules, produce results, and store the results for future use.

**Data:
Data** is a collection of unprocessed items, which can include text, numbers, images, audio and video.**Information** conveys meaning and is useful to people

**Information Process Cycle:**

* Computers process data (**input**) into information (**output**). Computers carry out **processes** using instructions, which are steps that tell the computer how to perform a particular task. A collection of related instructions organised for a common purpose is referred to as **software**.
* A computer often holds data, information and instructions in **storage** for future use.
* A computer takes raw data, follows a set of instructions from the user, to create information as a result

**Input device** is any hardware component that allows users to enter data and instructions (programs, commands and user responses) into a computer

An **output device** is any type of hardware component that conveys information to the user

**Motherboard:** main circuit board, connects to every part of the computer

**CPU:** brains of the computer, interprets and carries out basic instructions

**Multi-threading:** allows different parts of a single program to run concurrently

**Multi-core processor:** number of set processors in CPU, usually dual or quad core

**Benefits:**

* **Running multiple applications (improves performance/multi tasking)**
* **More energy efficient**
* **Emit less heat**
* **Improved power consumption**

 **GPU:** A specialised processor designed to rapidly manipulate and alter memory to accelerate the creation of images intended for output to a display
**Advantages:**

* **Less of the workload on CPU**
* **Frees up CPU to work on tasks**
* **Faster performance**

**Memory:**

* Memory consist of electronic components that store instructions waiting to be executed by the processor, data needed by those instructions and the results of processed data
* Memory usually consists of one or more chips on the motherboard or some other circuit board in the computer

**Memory can store;**

* The operating system and other system software that controls and maintains the computer system
* Application programs that carry our specific tasks such as word processing
* The data being processed by the application programs and resulting information

 **Resolution:** number of pixels per unit of area
**Aspect ratio:** How wide the picture was in relation to its height

**HDD – Hard drive:**

* Generally characterised – storage capacity
* Permanently store data for device use
* Mechanical-based platter hard drives
* Characterised by data read and write speeds

**SSD – Solid State Drive:**

* Almost no start up times as they have no mechanical moving parts
* Data is accessed directly from the flash memory
* No fragmentation of data
* Faster read/write times than HDD
* SSD’s draw fewer watts = less heat

**RAM:** RAM consists of silicon chips that can store instructions waiting to be executed and data needed by those instructions. Most RAM is primary storage which is volatile, meaning it gets erased when the electricity is turned off

**ROM:** read only memory, refers to memory chips storing permanent data and instructions

**Firmware:** permanent software programmed into ROM, non-volatile

**Cache:** helps speed the processes of the computer because it stores frequently used instructions and data

When the processor needs an instruction or data it searches memory in this order;

L1 cache built directly into the processor, very small capacity, fastest memory location.

L2 cache usually built directly on the processor, slower than L1 but larger capacity.

L3 cache on the motherboard separate from the chip. Faster than RAM but slower than L2.

Then the RAM and other much slower storage medium.

**Storage:** holds data, instructions and information for future use. Every computer stores system software and applications software. To start up, a computer locates an operating system in storage (usually a hard disk) and loads it into memory (RAM)

**Communication:**

connecting devices to each other in order to transfer data back and forth

* **USB:** universal serial bus
* **Bluetooth:** uses radio waves to transmit data between two devices
* **Plug and Play**
* **Internet**

**Specification of digital devices and their impact on usability:**

* **Determines what type of client will purchase what type of system**

**System requirements:**

* Specification is a list of the key components that make up the computer
* Most important components to take into account are:
	+ Processor
	+ RAM
	+ Hard Drive
* These are central to the overall capability of the system
* Hardware specifications will vary depending on what an individual user will be doing with it

**Specifications of a device changes due to;**

* User's needs
* Mobility/portability
* Screen size
* Media viewing vs media creation
* Collaboration
* Software/applications
* Input/output peripherals

**Mobile Employee Device Considerations:**

* Wireless internet capabilities – including Wi-Fi and Mobile Data access
* Battery life – around 8-10 hours will meet the daily needs of mobile users
* Weight – light and portable – less than 1kg is ideal
* Trackpad or touch inputs – difficult to use external peripherals of keyboard and mouse when not at a desk

**The impact of digital devices on usability:**

* Portable and flexible work style
* Added features
* Environmental impacts
* Collaboration
* Behaviour
* Relationships

**Mobile employees can forgo some specifications including:**

* Powerful processor
* A lot of RAM
* Large screen size
* Ideal devices: MacBook Pro, Surface

**Client desktop business user:**

Client business users would have desktops connected to a main high performance server or a cloud service. As most of the information is processed by the server, the client desktops would not require a high level of performance

**Hardware requirements would include:**

* High performance networking
* Adequate screen size
* Affordable

**Client business users can forgo some features including:**

* Mobility
* Fast processor
* Weight

**Design/Gamer device considerations:**

* Powerful multi core processors
* Lots of RAM
* High performance networking
* Large screen size
* High performance graphic cards

**How do specifications of digital devices impact upon their usability?**

* Screen size
* Storage
* Amount of RAM
* CPU speed/number of cores
* Battery life
* UI design

**Characteristics of development trends in emerging mobile devices:**

* **Finger print scanners**
* **Near Field Communication (NFC)**
* **Wearable technology**
* **Virtual reality**

**Finger print scanners:**

* Fingerprint scanners are a new trend amongst mobile phones
* Quick and secure unlocking mechanism
* Can work on third party apps
* More complex passwords
* affordable **biometric security** solution for businesses

**Near Field Communications (NFC):**

* Communication hardware that comes standard in phones nowadays
* Pays for transactions using phones or smart watches

**Wearable Technology:**

* Smart watches/bands: quick access to notifications, fitness tracking and communication become more convenient

**Suitability for Users (Business):**

* Positive impact on business
* Often care about health and well-beings which will impact on productivity levels
* Promotes a healthier workplace

**Virtual Reality:**

* Mobile technologies are now incorporating virtual reality, the mix of virtual element in the real world

**Suitability for users:**

* Seen through goggles; enable users to see through a virtual world based on physical movement
* Virtual training simulators; more affordable way to train employees
* More intensive experience of 360-degree video

**Usability of digital devices for specified client requirements**

The client or user is the most important part of the computer system

When recommending mobile devices, we need to make the following considerations;

**Weight/Portability**

* Size of device
* Weight of device

**Power and performance**

* Mobile employees are not performing complex, performance tasks on mobile devices
* Usually saved for high performance desktops at the business premises
* Need a CPU adequate enough to meet everyday tasks
* RAM to perform basic multitasking

**Battery life**

* Need to work on device for a day
* 8-hour battery life is ideal

**Internet accessibility and speeds**

* All mobile devices should be equipped with Wi-Fi
* Sim card port for cellular data

**User interaction medium**

* Touch screen
* Stylus

**Cost**

* Important mobile devices aren’t too expensive
* $1000 is ideal

**Impact of Technology:**

* the concept of intellectual property (IP)
* intention and purpose of IP in Australia in relation to copyright and/or design of digital products
* the concept of online defamation in Australia
* legal action available in Australia to counteract online defamation
* the concept of freedom of information (FOI) in Australia
* key provisions of FOI in Australia in relation to digital products
* advantages, disadvantages and implications of virtual and physical collaboration
* impact of convergence trends in contemporary digital technologies
* data and information security related to personal or sensitive information
* purpose of a code of conduct
* elements of a code of conduct, including:
	+ work hours
	+ employee email use
	+ employee internet use
	+ employee privacy
	+ employer’s monitoring of work emails, internet access and computer use
* online censorship of information in a global context
* issues with the use of cloud computing
	+ confidentiality of data
	+ sensitivity of documents
	+ level of accessibility
	+ availability of online applications
* impact of digital technologies and global markets on:
	+ productivity
	+ access to knowledge or resources
	+ outsourcing
* impact of Web 2.0/Web 3.0 on the use of digital technologies

Concept of IP

* Application of the mind to create/develop something new or original
* Creation of the mind
* Examples include inventions, artistic or literary works, designs
* Must be physical or tangible (not an idea)
* IP is covered by trademarks, patents, copyright

Copyright Act 1968

* Type of property that is founded on a person’s creative skill and labour
* Protects the form or way an idea or information is expressed, not the idea or information itself

Copyright protection

* Protects works
* Must be made by resident or citizen of Australia or made or first published in Australia, CP is granted automatically from the time an original work is created

Intention and purpose of IP in Australia in relation to copyright and/or design of digital products

* Patent – legal enforceable right for device, substance, method or process, stops other from creating/using/selling without permission
* Trademark – way of identifying product or service, can help discern quality of product over that of opposition
* Design – the way it looks through shape, configuration, pattern and ornamentation
* Plant breeders right – scheme protects plant breeders and gives them a commercial monopoly for period of time

Defamation:

* When someone spreads false rumours about you and as a result hurts your reputation

Legal action available:

* Ask them to take it down
* Report it to the social media site or site owner
* If these don’t work, then seek legal advice

It isn’t defamation if:

* The information is true
* Is published with the consent of the person
* Wasn’t very important, unlikely person’s reputation was damaged
* Parliamentary privilege cannot be sued or prosecuted for anything they say in debate in the houses

Freedom of Information

* The right to request access to documents from government ministers or agencies
* Allows for transparency in policy making
* Informed community can better participate in decision making process

Key provisions

* Allows individuals to see what information governments hold on them
* To seek correction if information is incorrect
* Enhances government transparency
* Gives information about government policies, programs and decision making processes
* Some exempt bodies include
	+ Australian Security Intelligence Organisation (ASIO)
	+ Defence Intelligence Organisation
	+ Police Department
	+ Electoral roll information
	+ Cabinet documents
* Common FOI requests include
	+ Access to information agencies hold on you
	+ Access to government documents
	+ Correct incorrect information

**Moral Rights:**

Moral rights are **personal rights that connect authors to their work**. Though they exist only in relation to copyright material, they are distinct from the economic rights included in copyright.

**Types of moral rights:**

* **Rights of attribution**: this is the right of an author to be **identified and named as the author of his/her work**;
* **Right against false attribution**: this is the right of an author to **prevent others to be identified and named as the author of his/her work**; and
* **Right of integrity**: this is the right of an author to ensure that his/her work is not **subjected to derogatory treatment**. The Copyright Act defines “derogatory treatment” as any act in relation to the work that is in any manner harmful to the author’s honour or reputation

Physical collaboration

* Working practise whereby individuals work together to a common purpose to achieve business benefit

Advantages:

* Effective cooperation
* Increase creativity
* Balance decision making
* Get advice or input from different professional backgrounds of expertise and creativity

Disadvantages:

* Stronger personalities dominate discussion
* Cost increase
* Longer decision times
* Conflicts within groups
* Roles and responsibilities become ambiguous

Virtual collaboration

* Geographically separated but work on shared outcomes, relying on technology to communicate

Advantages

* Less travel time
* Global shared information and resources
* Document trail
* Access to global contributors

Disadvantages

* Face to face relationships
* Global time zones
* Motivation when working with someone
* Technology fails
* Connectivity

Digital divide impacts businesses as they can’t collaborate with people without internet connections. It limits their audience

Impact of convergence trends and digital technologies

* Refers to the integration of two or more technologies in a single device
* Smartphone – alarm, watch, phone etc.
* Impact
	+ Phone companies and others need to branch out, change design, keep up with competitors or go out of business
	+ Unemployment since jobs are automated
	+ New businesses providing these technologies
	+ Fewer devices

Personal data

* Data which relate to a living individual who can be identified
* Sensitive personal data means personal data consisting of information as to
	+ Racial origin
	+ Political opinions
	+ Religious beliefs
	+ Member of trade union
	+ Physical/mental health
	+ Sexual life

Privacy Act:

* Law which regulates handling of personal information about an individual
* Privacy principles include
	+ Collection of personal information
	+ How it’s used
	+ Access to personal information
	+ Implications of identity theft
	+ Safe disposal of data

Code of conduct:

* Protects a business by informing employees of the expectations of the employer/business
	+ Employee privacy
	+ Email use
	+ Work hours
	+ Internet use
	+ Monitoring of work emails, internet access and computer use

Online censorship:

* Control or suppression of what can be accessed, published or viewed on the Internet
* Range from well-intentioned desires to protect children to authoritarian attempt to control national access

Cloud computing

* Practise of using a network of remote servers hosted on the internet to store, manage and process data

Issues:

* **Downtime (if internet is down)**
* **Security**
* **Less control of data**
* **Sensitivity and confidentiality fr**
* User loses control of data
* Stored on a computer belonging to someone else
* Privacy – risk of data being disclosed accidentally or deliberately
* Increased potential for confidential data to be released
* Lack of customer focus as third party involved
* Cloud providers can share information with third parties if necessary for purpose of law and order even without a warrant
* Threat of data compromise
* SLAs not being met
* Unreliable internet connection possibilities
* Cloud based tools have reduced the need for locally installed apps (Office application, mail, resume)

Impact of digital technologies and global markets

Productivity:

* Changed the way businesses operate
* Provide more opportunities
* Automation and robotics increase productivity (farming, mining, transport)
* Analytics and data mining allows for increases in productivity through better business decisions

Access to knowledge

* 24/7 access to
	+ Universities and schools
	+ Entertainment
	+ Work, cloud storage, emails
	+ E-commerce
	+ Social media
	+ Gambling

Outsourcing:

* Getting other companies to do some of a company’s normal business activity
* Customer support outsourced off shore by Telstra

**Managing Data:**

* Concept of user generated content
	+ Advantages
	+ Disadvantages
* Concept of HTML
* Concept of Web 2.0 and Web 3.0
* Purpose and features of CMS
* Purpose of W3C
* Purpose of W3C conventions
* Validation techniques for online forms
* Security techniques for the management of data including
	+ Disaster recovery plan
	+ Audit trail
* Types of backup techniques and archiving of data
	+ Full
	+ Differential
	+ Incremental
	+ Daily
* Online data storage methods
	+ Data warehouses
	+ Data marts
	+ Data in the cloud
* Purpose of data mining
* Processing of data considering security of data through the use of
	+ Passwords
	+ Firewalls
	+ Biometrics
	+ Anti-virus software
	+ Digital signatures
	+ Digital certificates
	+ Encryption

UGC is where voluntary contributors can publish online content. Some popular examples include:

* Wikipedia
* Social networks
* Forums
* Review websites
* Online classifieds

Benefits for a website owner:

* Free
* General feedback is seen as reliable, valuable toward feedback and decision making
* Self-policing opportunities
* Keep users engaged

Cost for a website owner:

* Bias – hold strong opinions, may not contribute balance perspective
* Lack of reliability and credibility – no guarantee information is factual
* Online defamation risk
* Confusion over intellectual property

Web 2.0

Web 2.0 is the current version of the web that focuses on sharing of information and virtual collaboration. Web 2.0 is centred around the following characteristics:

* Dynamic user interfaces, evolved from static user interfaces of web 1.0
* Emergence of social networking and other virtual collaboration tools
* Finding information more easily with more developed and faster search engines

Web 3.0

Web 3.0 is the future version of the web that focuses on the following characteristics:

* Greater connectivity between internet enabled devices – development of the internet of things where ordinary household’s devices will be able to communicate wirelessly
* Internet searches based on a user’s own internet rather than keywords
* Intelligent processing of information with web technologies learning from past user activity – e.g. eBay learning our interests based off a user’s past searches and generating a ‘Recommended for You’ list of products
* Faster and more complex online applications

According to the W3C, “The Semantic Web provides a common framework that allows data to be shared and reused across application, enterprise, and community boundaries”

W3C

The World Wide Web Consortium is an international community consisting of member organisations, a full time employee and the public for the purposes of developing web standards to ensure web accessibilities and to ensure that the web evolves in one direction rather than being split amongst multiple directions by rival groups

CMS

A content management system is a computer application that supports the creation and modification of digital content using a common user interface and usually supports multiple users working in a collaborative environment

Content management systems will often contain the following features:

* SEO-friendly URLs (Search Engine Optimisation)
* Integrated and online help
* Management of document formats to scan documents into pdf or html
* Modularity and extensibility
* User and group functionality
* Templating support for changing designs
* Install and upgrade wizards
* Integrated audit logs
* Compliancy with various accessibility frameworks and standards

Web standards:

Web standards are a set of rules that web developers should follow when developing and choosing file formats for their websites. Of course, anyone can do anything on the web, but the rules act as a guide to ensure accessibility and compatibility for all users. Some standards are included below:

* Portable Network Graphics (.png) for images
* Hypertext Markup Language (.html) for the markup language
* Cascading style sheet (.css) for the design of a website
* Accessibility standards – certain colours, languages, button sizes etc.

Some data protection methods that can be used to protect computer data

1. Authentication
2. Encryption, HTTPS, SSL, signatures and certificates
3. Secure wired and wireless networks – firewalls
4. Data back and recovery methods
5. Educate employees
6. Physical security methods

Data validation

The process of ensuring that a program operates on a clean, correct and useful data. It uses routines, often called ‘validation rules’

Form validation

Data validation is intended to provide certain well-defined guarantees for fitness, accuracy and consistency for any of various kinds of user input into an application or automated system

* Data type validation i.e. must be date “dd/mm/yy”
* Simple range and constraint validation i.e. “DOB is over 18 years”
* Allowed character checks, check digits i.e. “@.com” in email
* Consistency checks i.e. If title = Mr, then Gender = M
* Data type checks – input and give an error message if the input data does not match with the chosen data type, e.g. in an input box accepting numeric data, if the letter ‘O’
* Spelling and grammar checks look for spelling and grammatical errors

Disaster

* Scale that disrupts or threatens critical functions or an organisation, society or system for a period of time

Disaster Recovery Plan:

* Written plan to restore business ICT equipment after a disaster has taken place

Audit trail:

* A record showing who has accessed a computer system and what operations he or she has performed during a given period of time
* Audit trails are useful both for maintaining security and for recovering lost transactions
* Records details about access to specific documents including:
	+ When the data was accessed
	+ Who accessed it
	+ What was accessed
	+ In most cases, it does not show why the data was accessed. Sometimes very secure systems may ask for a reason before asking sensitive data

Types of techniques and archiving data:

* Backup: the copying and archiving of computer data so it may be used to restore the original after a data loss event
* Full back up: stores a copy of all files and typically occurs automatically according to a pre-set schedule
	+ Consume a lot of storage
	+ Heavy access to the backup disk
	+ Shorten disk life
	+ Multiple identical copies of files are created
	+ Consume network bandwidth
* Incremental backup
	+ Save space by backing up only the files that have been created or changed since the last backup
	+ Each file must be compared with the last full back up as well as the incremental iterations to determine whether data is new or changed. Therefore, incremental backups increase computing power
* Advantages:
	+ Many businesses backup strategies include a combination of full backups and incremental backups
	+ Running a full back up once per week – on weekends when network and computing resource demands are lower
	+ Smaller storage of incremental changes backups on weekdays
* Differential backup:
	+ Copies files that have been created or changed since the last full or incremental backup
	+ If you are performing a combination of full and differential backups, restoring files and folders requires that you have the last full as well as the last differential backup
* Advantages:
	+ Simplifies recovery because only the last full backup and the last differential
	+ Uses less space than a full backup
	+ Faster to complete a differential backup than a full backup
* Disadvantages
	+ Backup files are scattered amongst multiple locations
* Daily
	+ A backup that makes a copy of all new or modified files on the day of the backup
	+ Daily backups are performed everyday
* Advantages
	+ Uses least amount of space
	+ Shortest backup times
	+ Regular backing up of files
* Disadvantages
	+ Backup files are scattered amongst the multiple location
	+ Largest amount of storage needed as full backup each night

Data mining:

* Process used with data warehouses to find patterns and relationships among data

Marketing purposes:

The main purpose of data mining is marketing purposes to which this information is collected to build a profile about a user, with personal information including their name, age, interests, sex, dislikes and geographical location

Other purposes:

* Medical and scientific
* Security purposes

Data in the cloud:

Refers to online cloud storage, where data is stored offsite of business premises, onto Internet connected servers located around the world. Security and privacy of the data is surrendered to the cloud storage provider and what they can and cannot do with the data is outlined in their license agreement

Data mart:

* Smaller version of data warehouse that version of a database that helps a specific group or department make decisions

Data warehouse:

* A large store of data accumulated from a wide range of sources within a company and used to guide management decisions

Authentication: act of confirming the truth of an attribute or single piece of data or entity

Security research has determined that for a positive authentication, elements from at least two, and preferably all three, factors should be verified;

* The knowledge factors: something the user knows (password, PIN)
* The ownership factors: something the user has (wrist band, ID card, phone)
* The inherence factors: something the user is or does (fingerprint, DNA, retinal scan)

Password: word or string of characters used for user authentication to provide identity or access approval to gain access to a resource

* Enforcing a password policy to increase password strength and security
* Requiring periodic password changes
* Assigning randomly chosen passwords
* Requiring minimum password lengths
* Some systems require characters from various character classes in a password

Biometrics: refers to metrics related to human characteristics. Biometric authentication is used in computer science as a form of identification and access control

Firewall: hardware or software that protects a network’s resources from unauthorised access or intrusion by users on another network for instance the internet.

Anti-virus software: developed to detect and remove computer viruses

Digital signatures:

* encrypted code that a person, website or organisation attaches to an electronic message to verify the identity of the message sender
* Used to validate the authenticity and integrity of a message, software or digital document

Digital certificate: recognition that guarantees a user or a website is legitimate, public key certificate prove the ownership of a public key

Digital certificates vs digital signature:

Digital certificates are used to verify the trustworthiness of a website, while digital signatures are used to verify the trustworthiness of information

Encryption: process of converting readable data into unreadable characters to prevent unauthorised access

* Treated just like any data (stored, sent)
* To read, it must be decrypted or deciphered into a readable form
* The unencrypted data is called plaintext
* Encrypted data is called ciphertext
* Cypher is a set of steps that can convert readable plaintext into unreadable ciphertext
* Encryption key is a set of characters that the:
	+ Originator of the data uses to encrypt the plaintext and;
	+ The recipient of the data uses to decrypt the ciphertext

Two basic types of encryption are

Private key encryption:

* Both the sender and receiver of data must use the same secret key to encrypt and decrypt the data
* Only a single private key can encrypt or decrypt information
* Fast process
* Confidential
* Symmetric key encryption

Public key encryption:

* Uses two encryption keys: public key and private key
* Public key encryption software generates both

**Networks:**

* Type and characteristics of communication protocols including
	+ Transmission control protocol/internet protocol (TCP/IP)
	+ Hypertext transfer protocol (HTTP)
	+ Hypertext transfer protocol over secure socket layer (HTTPS)
	+ Wireless application protocol
* Types and characteristics of communication standards including
	+ 11x (wireless)
	+ 3 (Ethernet)
* Types of network security measures
	+ Firewalls
	+ Passwords
	+ Physical security

**Switches –**A switch (advanced version of a hub) is a device that provides a central connection point for cables from workstations, servers, and peripherals. Often the centre of a star network. Connects multiple networks.

**Routers –**Routers are the traffic directors of the global internet. All routers maintain complex routing tables which allow them to determine appropriate paths for packets destined for any address. Routers communicate with each other, and forward network packets out of or into a network.

**Firewall –**A firewall is a networking device that is installed at the entrance to a LAN when connecting networks together, particularly when connecting a private network to a public network, such as the internet. The firewall uses rules to filter traffic into and out of the private network, to protect the private network users and data from malevolent hackers.

**Server** - In computing, a server is a computer program or a device that provides functionality for other programs or devices, called "clients". This architecture is called the client/server model. A single server can serve multiple clients, and a single client can use multiple servers. Typically, servers can provide one or many of the following services i.e. database, file, mail, print, web, game, and application servers. Authenticates users, computers and connected peripherals

Modems – convert digital signals to analogue signals

Network standards:

* Defined guidelines for how computers or networked devices communicate
* Common language that computers can communicate with each other
* Apple and PC example

Protocol:

* Mechanics of how the standard is implemented
* Defines how the computers connect, how they transfer data

IEEE 802.3 – Ethernet

* Network standard that specifies no central computer or device on the network
* Ethernet can be configured to a star network
* Defines guidelines for the physical connectors and configuration of modern networks using RJ45 cables
* Modern Ethernet speeds are 100Mbps
* Gigabit Ethernet operates at 1000Mbps

Advantages

* Inexpensive
* Easily installed
* Easily maintained

Disadvantages

* If two computers on the same network attempt to send data at the same time, a collision will occur, and the data will have to be resent

Wife

* Standard by which computers and devices can communicate wirelessly via radio waves
* Wife sometimes referred to as wireless Ethernet because it uses similar techniques to the Ethernet standard to specify physical connectivity

IEEE 802.11 (wireless)

* a/b/g/n/ac
* A set of media access control (MAC) and physical layer (PHY) specifications for implementing wireless local area network (WLAN) computer communication

TCP/IP

* Transmission control protocol/internet protocol
* Adopted standard for internet communications
* Two-layer program
	+ Higher layer manages the assembling of a message or file into smaller packets that are transmitted over the Internet and received by a TCP layer that reassembles the packets into the original message
* Internet protocol handles the address part of each packet so that it gets to the right destination
* Each gateway computer on the network checks this address to see where to forward the message. Even though some packets from the same message are routed differently than others they’ll be reassembled at the destination
* It is a specific protocol that defines how messages are routed from one end of a network to the other, ensuring data arrives correctly
* Rules for dividing transmitted information into small pieces called packets and regulating the flow of messages along the network
* Each packet contains
	+ The data
	+ Destination information
	+ Sender information
	+ Sequence information used to reassemble the data at the destination
* Each packet travels along the fastest individual path to the destination device/computer via communication devices called routers
* This is called packet switching

Protocol:

* The format and order of messages exchanged between two or more communicating entities
* A technical standard is an established norm or requirement in regard to technical systems

HTTP: (hypertext transfer protocol)

* TCP/IP based communication protocol that is used to deliver data on the world wide web
* HTTP specifications specifies how clients’ request data will be constructed and sent to the server and how the servers respond to these requests
* HTTP protocol is a request/response protocol based on the client/server based architecture
	+ User issues URL from a browser
	+ Browser sends request message
	+ Server maps the URL to a file or program under the document directory
	+ Server returns a response message
	+ Browser formats the response and displays

URL:

* Uniform Resource Locator is used to uniquely identify a resource over the web

HTTPS: (‘HTTP’ over secure socket layer)

* Secure version of HTTP
* Communication between your browser and the website are encrypted
* Often used to protect highly confidential online transactions like online banking and shopping
* Typically uses one of two secure protocols top encrypt communications – SSL (Secure Sockets Layer) or TLS (Transport Layer Security)

WAP: (wireless application protocol)

* Wireless Application Protocol
* Provides the standard by which older mobile devices can display content of internet services such as web, email and chat rooms
* Micro-browser for the phone or mobile devices that are WAP compatible is required to access WAP sites
* WAP works in conjunction with TCP/IP network standard
* Not used by modern smartphones

Bluetooth:

* Protocol defining how two devices that are Bluetooth use short range radio waves to transmit data
* Transfer rates of up to 3Mbps
* Bluetooth devices must contain a small chip that allows it to communicate with other Bluetooth devices

Infrared:

* Wireless transmission standard to transmit data wirelessly via infrared
* Requires line of sight transmission
* Devices must be in view of each other

**Network security** consists of the policies and practices adopted to prevent and monitor unauthorized access, misuse, modification, or denial of a computer network and network-accessible resources. Network security involves the authorization of access to data in a network, which is controlled by the network administrator.

Network security starts with **authenticating**, commonly with a username and a password. Since this requires just one detail authenticating the user name—i.e., the password—this is sometimes termed one-factor authentication. With two-factor authentication, something the user 'has' is also used (e.g., a security token or 'dongle', an ATM card, or a mobile phone); and with three-factor authentication, something the user 'is' also used (e.g., a fingerprint or retinal scan).

There are three types (factors) of **authenticating**information:

1. something the user knows, e.g. a password, pass-phrase or PIN
2. something the user has, such as smart card or a key fob
3. something the user is, such as fingerprint, verified by biometric measurement

**Firewall**enforces access policies such as what services are allowed to be accessed by the network users.

**Firewall** is a network security system that monitors and controls the incoming and outgoing network traffic based on predetermined security rules

**Anti-virus software** or an intrusion prevention system help detect and inhibit the action of such malware. Trojans, worms, denial of service, eavesdropping, rootkits and key loggers.

Communication between two hosts using a network may be **encrypted**to maintain privacy.

**Physical security** includes guards, pass checkers, walls, buildings, locks and keys (restrict entrance to authorised people only)

Transmission Media:

Classes:

* Conducted or guided media
	+ Uses a conductor to move the signal from sender to receiver
* Wireless or unguided media
	+ Uses radio waves of different frequencies and do not need a wire or cable conductor to transmit signals

Guided transmission media:

* Transmission capacity depends on the distance and on whether the medium is point-to-point or multipoint
* Examples include twisted pair wires, Ethernet and optical fibre

Twisted pair:

* Minimise the electromagnetic interference between adjacent pairs
* Often used at customer facilities and also over distances to carry voice as well as data communications
* Low frequency transmission medium
	+ STP (Shielded Twist Pair)
	+ UTP (Unshielded…)
* Advantages:
	+ Inexpensive/readily available
	+ Flexible and light weight
	+ Easy to work with and install
* Disadvantages:
	+ Susceptibility to interference and noise
	+ Attenuation problems
	+ Relatively low bandwidth

Fibre Optic Cable:

* Relatively new transmission medium used by telephone companies in place of long-distance trunk lines
* Also used by private companies in implementing local data communication networks
* Requires a light source with ILD or LED
	+ Multimode step index fibre
	+ Multimode graded-index
	+ Single mode fibre
* Advantages:
	+ Greater capacity over longer distances
	+ Smaller and light weight
	+ Lower attenuation
	+ Immunity to environmental interference
	+ Highly secure due to tap difficulty and lack of signal radiation
* Disadvantages:
	+ Expensive over short distance
	+ Requires highly skilled installers
	+ Adding additional nodes is difficult

Wireless (Unguided Media) Transmission

* Transmission and reception are achieved by means of an antenna
* Directional
* Omnidirectional
* Examples
	+ Terrestrial microwave
	+ Satellite microwave
	+ Broadcast radio
	+ Infrared

A basic LAN structure:

ISP 🡪 Modem 🡪 Firewall 🡪 Router 🡪 Switch 🡪 WAP

**Cloud Computing:**

The practice of using remote servers hosted on the Internet to store, manage and process data rather than a local server or a personal computer

**Advantages of cloud computing:**

1. **Achieve economies of scale** – **increase volume output or productivity with fewer people**. Your cost per unit, project or product plummets
2. **Reduce spending on technology infrastructure** – **maintain easy access to your information with minimal upfront spending**. Pay as you go (weekly, quarterly or yearly), based on demand
3. **Globalize your workforce on the cheap** – **people worldwide can access the cloud**, provided they have an internet connection
4. **Streamline processes** – get more work done in less time with less people
5. **Reduce capital costs** – there’s **no need to spend big money** on hardware, software or licensing fees
6. **Improve accessibility** – you have **access anytime, anywhere**, making your life so much easier
7. **Monitor projects more effectively** – stay **within budget** and **ahead of completion cycle times**
8. **Less personnel training is needed** – it takes **fewer people to do more work on a cloud**, with a minimal learning curve on hardware and software issues
9. **Minimize licensing new software** – **stretch and grow** without the need to buy expensive software licenses or programs
10. **Improves flexibility** – you can **change direction** without serious “people” or “financial” issues at stake

**Disadvantages:**

**Technical issues**

* Technology is always prone to outages and other technical issues
* Will need a very good internet connection to be logged onto the server at all times

**Security in the cloud**

* You will be surrendering all your company’s sensitive information to a third party cloud service provider

**Prone to attack**

* Companies can be vulnerable to external hack attacks and threats

**What technologies have enabled cloud computing:**

* The internet
* Faster computing and processing speeds
* Fast internet
* Larger storage capacities
* Cheap data storage
* Wireless communication

**Verifiability:**

* the extent to which information can be checked for reliability, truth and accuracy
* comes from sources with references and citations
* checked to see if it is truthful

**Accuracy:**

* the information represents what actually exists

**Currency:**

* information contains latest facts and figures
* check the time stamp on websites