

Computer Game Platforms and Technology

# Assignment 1

Unit 36

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## Task 1

- **1971** – The first ever Arcade machine is created based off a PDP-11 machine: Galaxy Game. With later in the year the first commercial arcade machine launches: Computer Space
- **1972** – The first gaming console is launched: the Magnavox Odyssey – playing Pong. Later in the year Atari released Pong for the arcade which was considered
- **1976** – The first game to use ‘Snake’ like mechanics is released: Blockade by Gremlin
- **1978** – Space Invaders is released – the first blockbuster arcade game and starts the golden era of arcade machines
- **1978** – Intel releases the first x86-based CPU at 32-bits
- **1979** – Arcade games start to use RGB following the release of Galaxian by Namco
- **1982** – The first computer is released: the Commodore 64 which uses an actual processing unit compared to the Magnavox Odyssey which just used transistors, resistors, and capacitors
- **1982** – Arcade games start to use 16-bits following the release of Pole Position by Namco
- **1985** – The first VR company is founded – VPL Research
- **1991** – Virtuality Group releases “Virtuality” – a VR arcade machine with multiplayer potential
- **1994** – The first PlayStation is released – one of the first consoles to use CDs instead of cartridges as games
- **1997** – Nokia releases the Nokia 6110 which you play Snake
- **1998** – Java is released for mobile
- **1999** – The 64-bit version of the x86 architecture is released
- **2007** – Apple releases the iPhone and the App Store creating a new market to buy, download and play games
- **2019** – The world’s first truly wireless VR headset is released – the Oculus Quest

## Task 2

	Features	Limitations
<b>Arcade Game Platforms</b>	<ul style="list-style-type: none"> <li>• You don’t need any of your own equipment</li> <li>• 8-bit graphics</li> <li>• Joystick controllers</li> <li>• Coin operated</li> </ul>	<ul style="list-style-type: none"> <li>• Must pay to play each time</li> <li>• Can only play in an arcade</li> <li>• No online multiplayer</li> <li>• Not very portable</li> </ul>
<b>Console Game Platforms</b>	<ul style="list-style-type: none"> <li>• Good graphics</li> <li>• Wide variety of games</li> <li>• Online multiplayer</li> <li>• Can be taken to other houses</li> <li>• Other inputs can be connected – mouse + keyboard</li> </ul>	<ul style="list-style-type: none"> <li>• Pay for multiplayer (e.g., through XBOX Live or PlayStation Plus)</li> <li>• Requires a TV or monitor to use</li> <li>• Some consoles have an FPS limit</li> <li>• Controller needs batteries to use</li> </ul>

<b>PC Games Platforms</b>	<ul style="list-style-type: none"> <li>• You can spec out your PC to your liking – make it as powerful as you need</li> <li>• Free online play</li> <li>• Can use wide range of inputs</li> <li>• More freedom than locked down consoles and phones</li> </ul>	<ul style="list-style-type: none"> <li>• Cost a lot of money</li> <li>• Not all PCs are powerful enough to play every game</li> <li>• Compatibility issues</li> </ul>
<b>Mobile Games Platforms</b>	<ul style="list-style-type: none"> <li>• Many are free to play</li> <li>• All phones can run most mobile games</li> <li>• Can take up a lot of phone store space</li> </ul>	<ul style="list-style-type: none"> <li>• Lots of adverts</li> <li>• Limited phone battery</li> <li>• Repetitiveness</li> <li>• Many micro transactions</li> </ul>
<b>TV Games Platforms</b>	<ul style="list-style-type: none"> <li>• Easily accessible</li> <li>• Can be decent graphics</li> </ul>	<ul style="list-style-type: none"> <li>• Hard to play on a TV remote</li> <li>• Limited games – usually no app store</li> </ul>

## Task 5

### Introduction

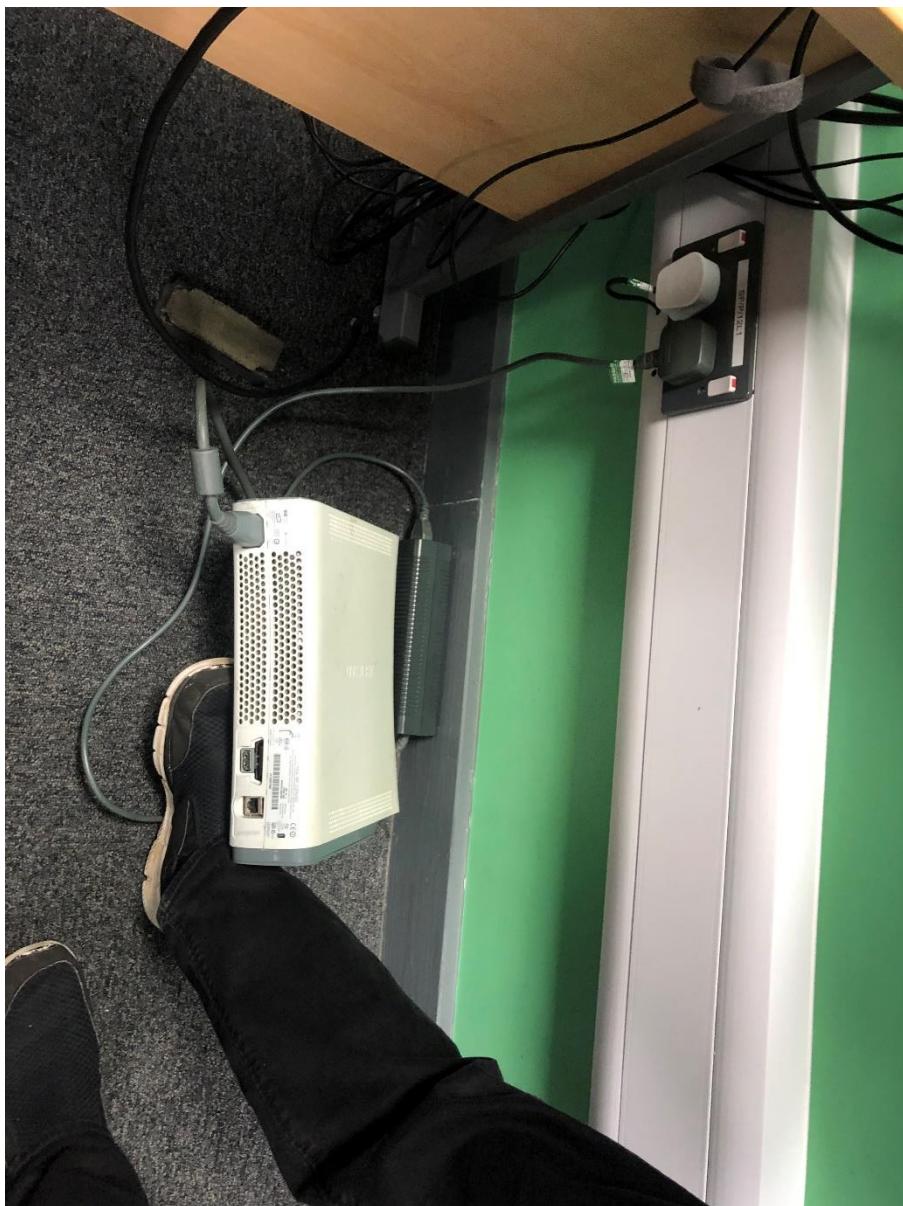
To demonstrate my knowledge and ability to connect, setup and configure a gaming device. For this demo, I chose to configure an Xbox 360 with a wired controller, Kinect, and WiFi. I then picked a game that uses WiFi and the Kinect and played it to ensure everything was working correctly.

## Step 0



Here is everything I will be using to setup and configure the device with. This includes the Xbox 360 itself, its power brick, the WiFi extension, a HDMI cable to connect to a TV, the Xbox controller, the Kinect and a compatible game CD.

Step 1 – Power the Xbox



Here I plugged the power brick into the wall and then plugged the brick into the Xbox so it can power on.

Step 2 – Attach the WiFi Extension



To enable the Xbox to connect to my WiFi network, I plugged in the WiFi extension into one of the USB ports on the back of the console.

Step 3 – Connect the display



Here I have plugged the HDMI cable into the back of the Xbox and then directly into the HDMI IN port on the TV so we can see the game we want to play and the Xbox UI.

Step 4 – Connect the controller



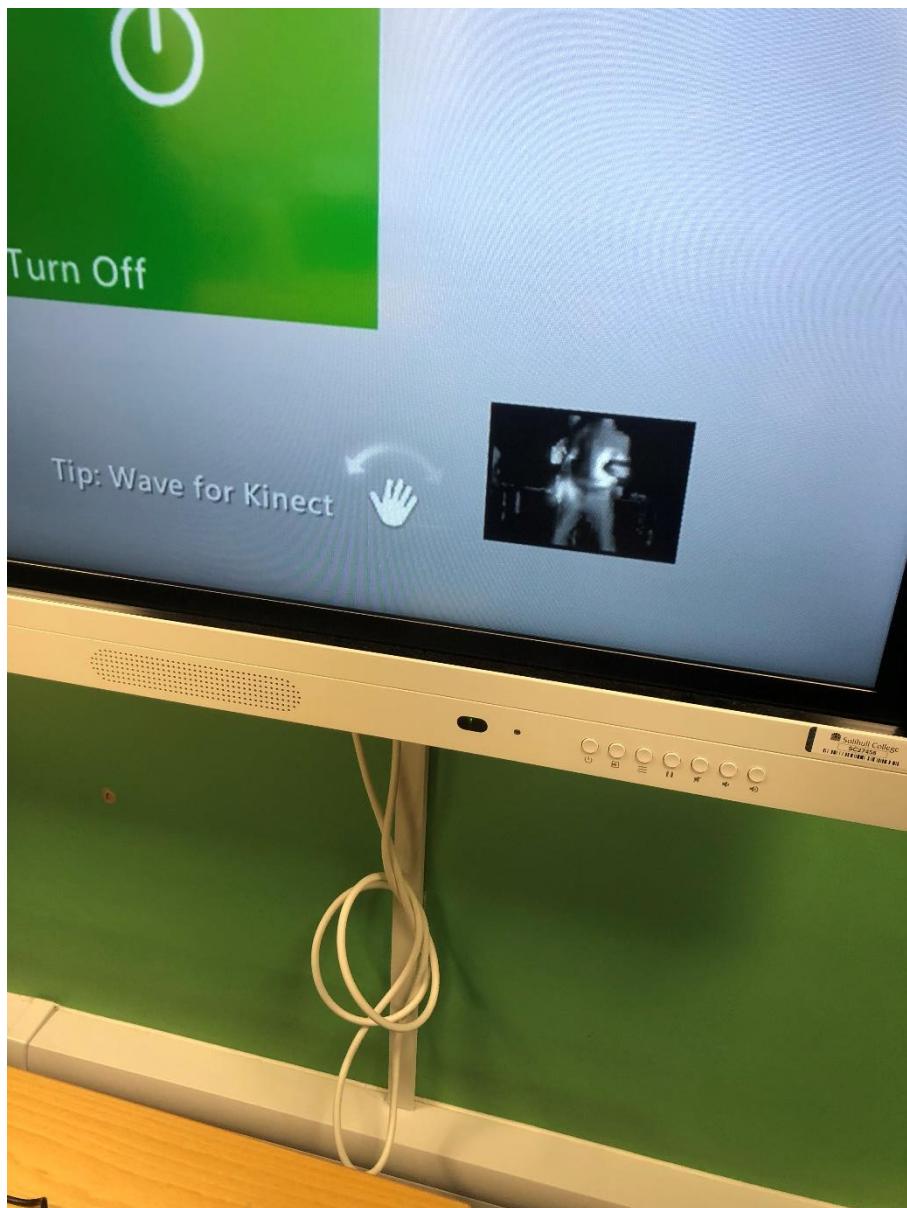
This will enable us to be able to interact with the Xbox's UI so we can further setup the console and play most games on it.

Step 5 – Connect the Kinect



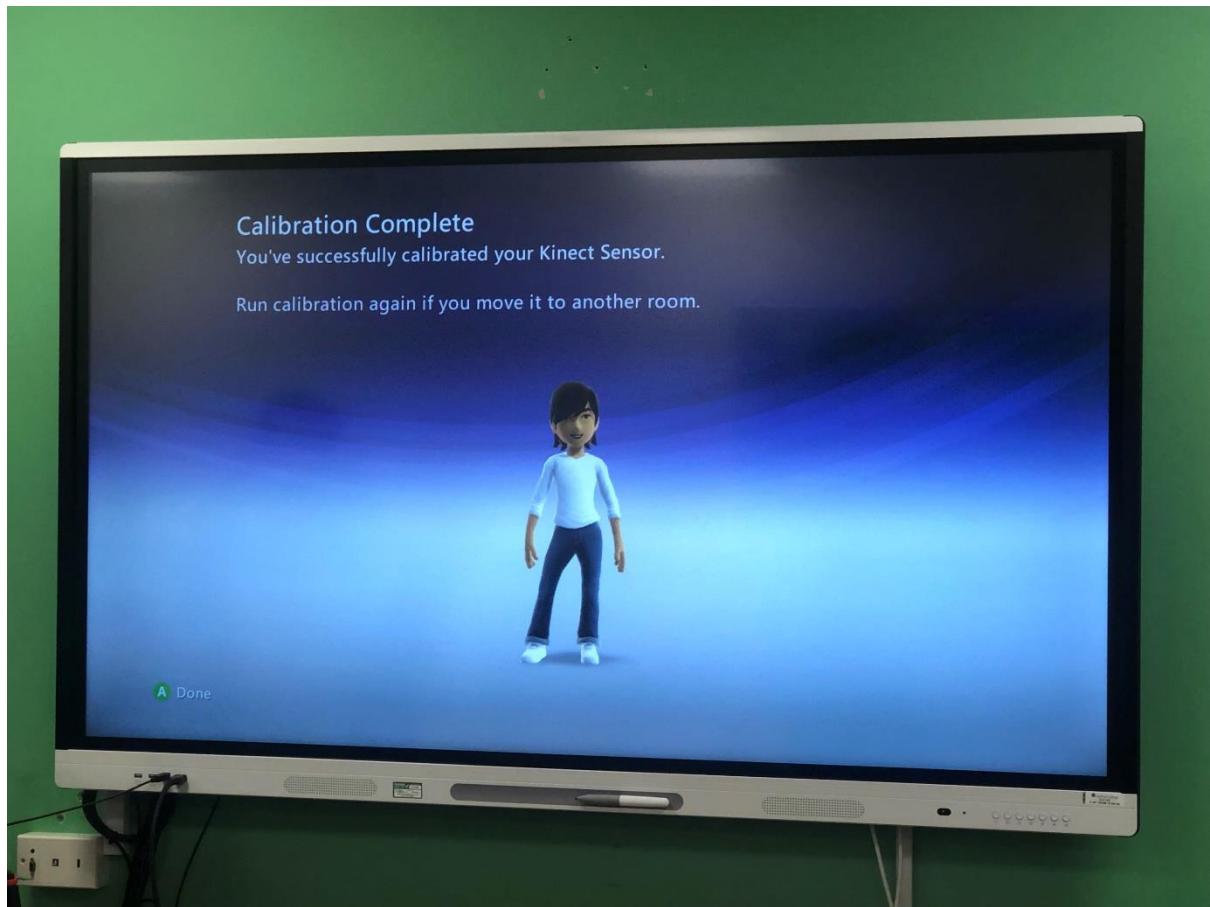
This will allow us to play Xbox Kinect games as it tracks body movement to be used in-game.

Step 6 – Power on and calibrate the Kinect



After powering on the Xbox, we are greeted with what the Kinect can see, and we are prompted to calibrate it using the provided calibration card.

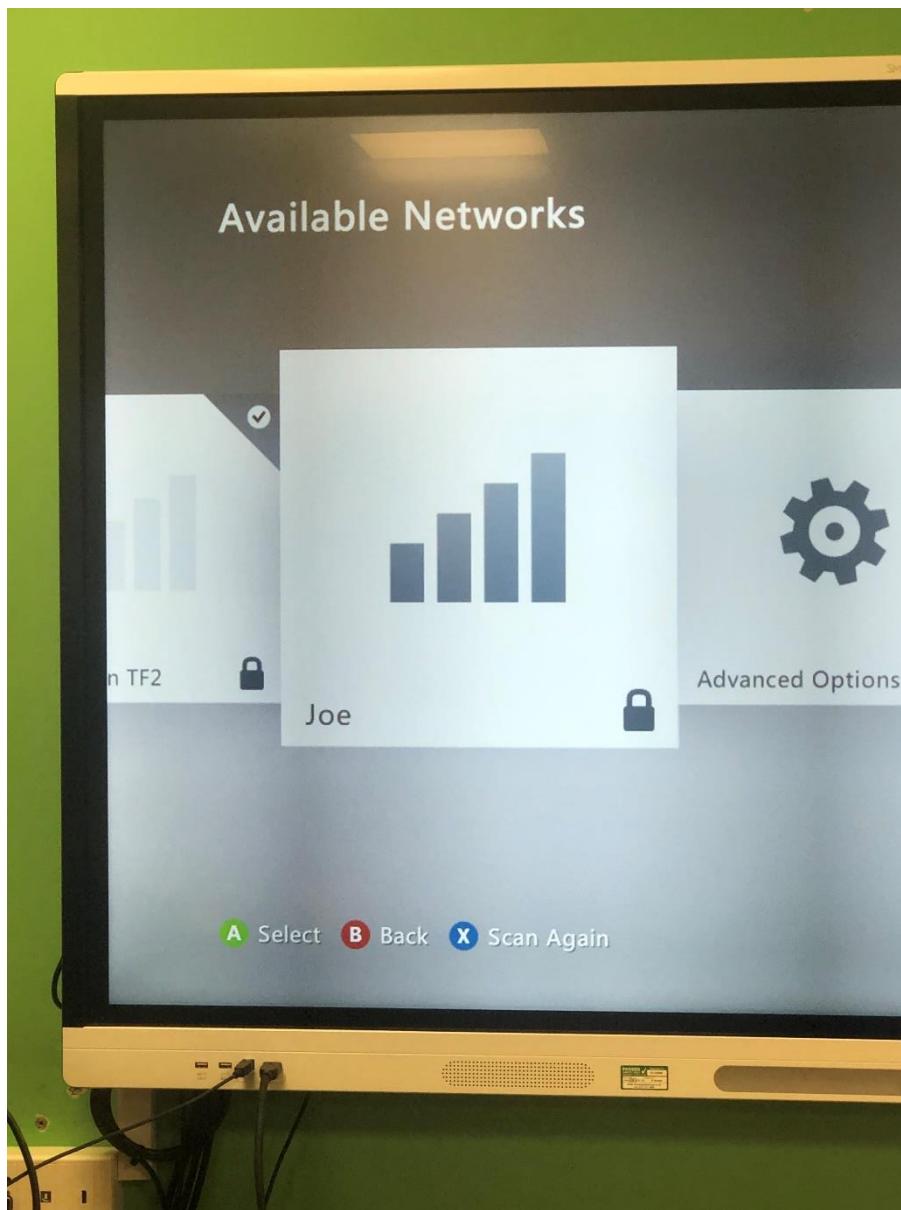




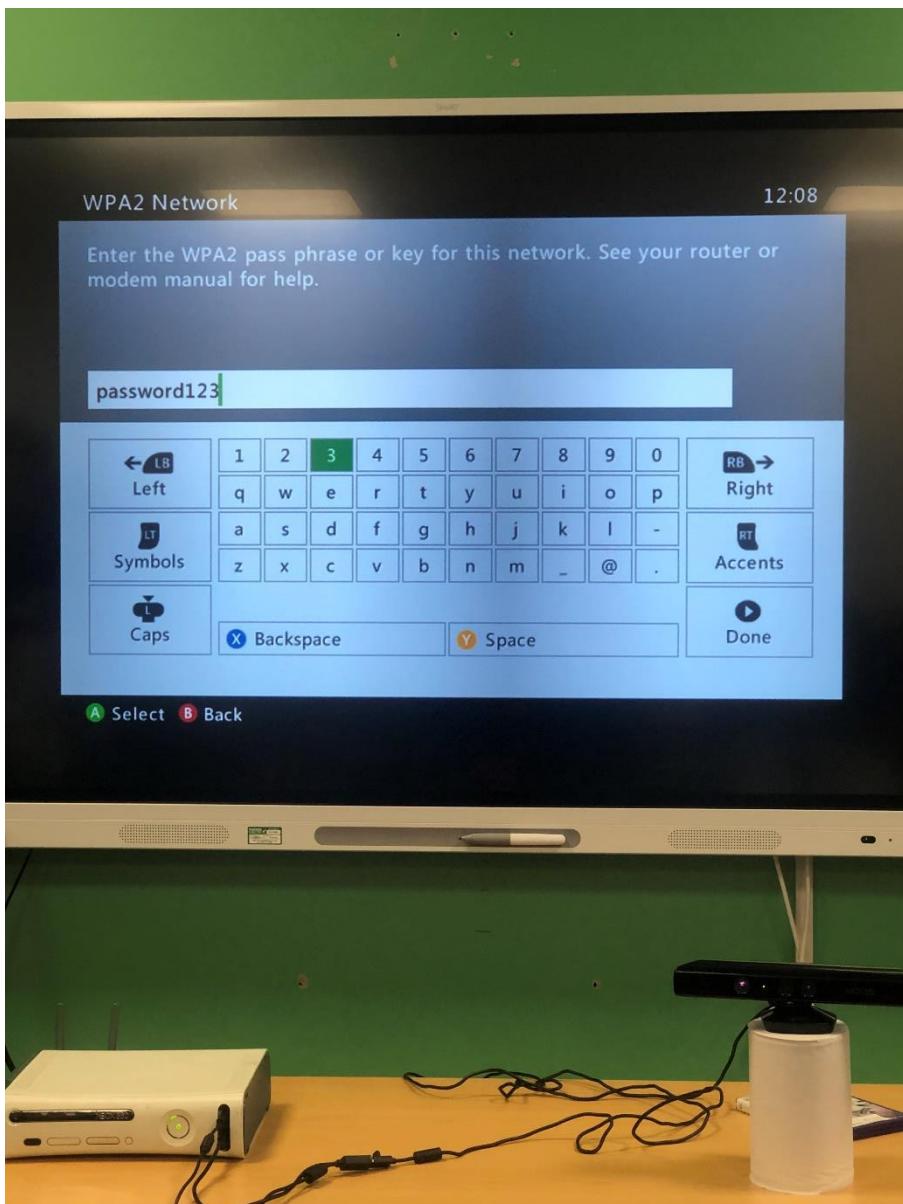
The calibration is done by positioning a provided card within the Kinect's vision, so it knows where and how to track your body.



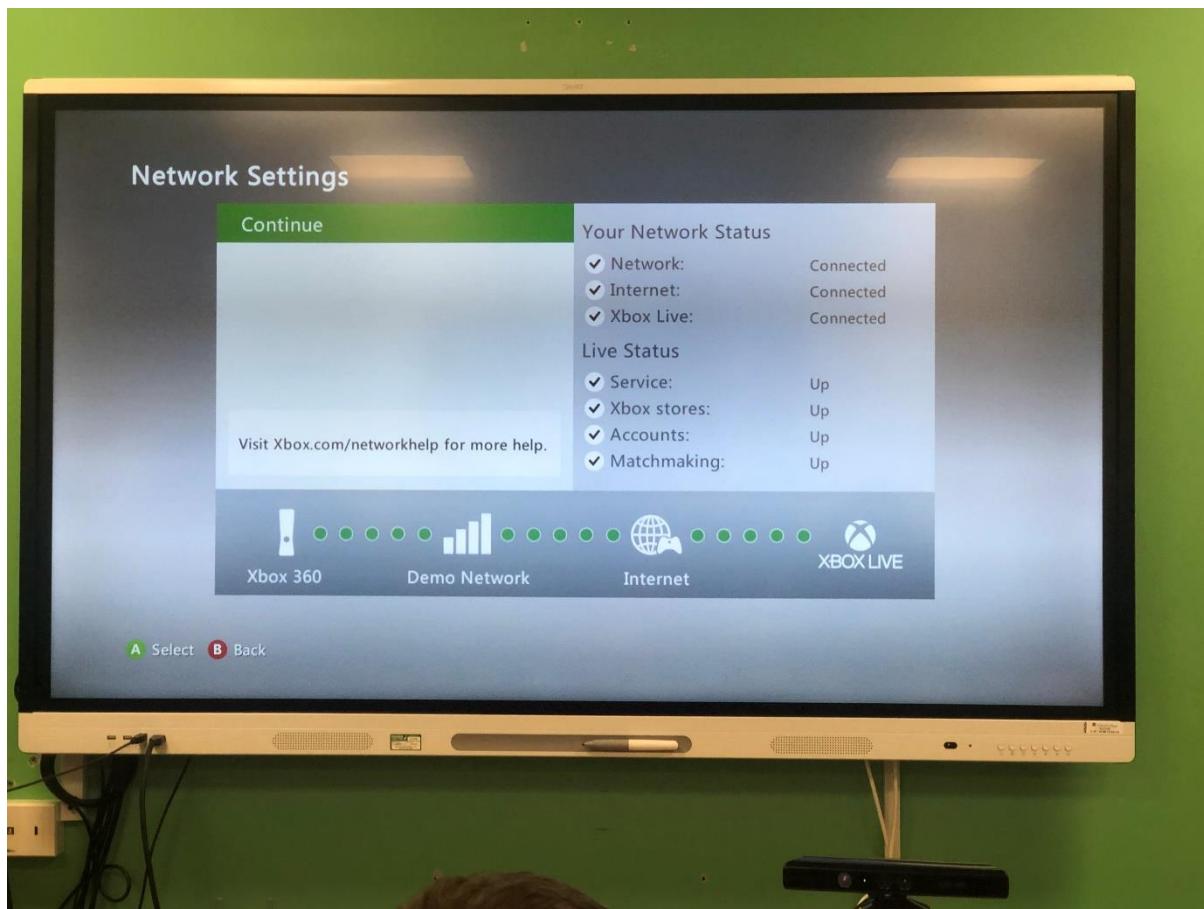
Step 7 – Connect to WiFi



First I went into settings and select ‘Connect to WiFi’, then I searched for my WiFi network. I originally attempted to connect to the network named ‘Joe’, but as that didn’t work I tried using my ‘Demo Network’.



Here I entered the password for the network. The Xbox then ran some tests to ensure it could properly connect to the network.

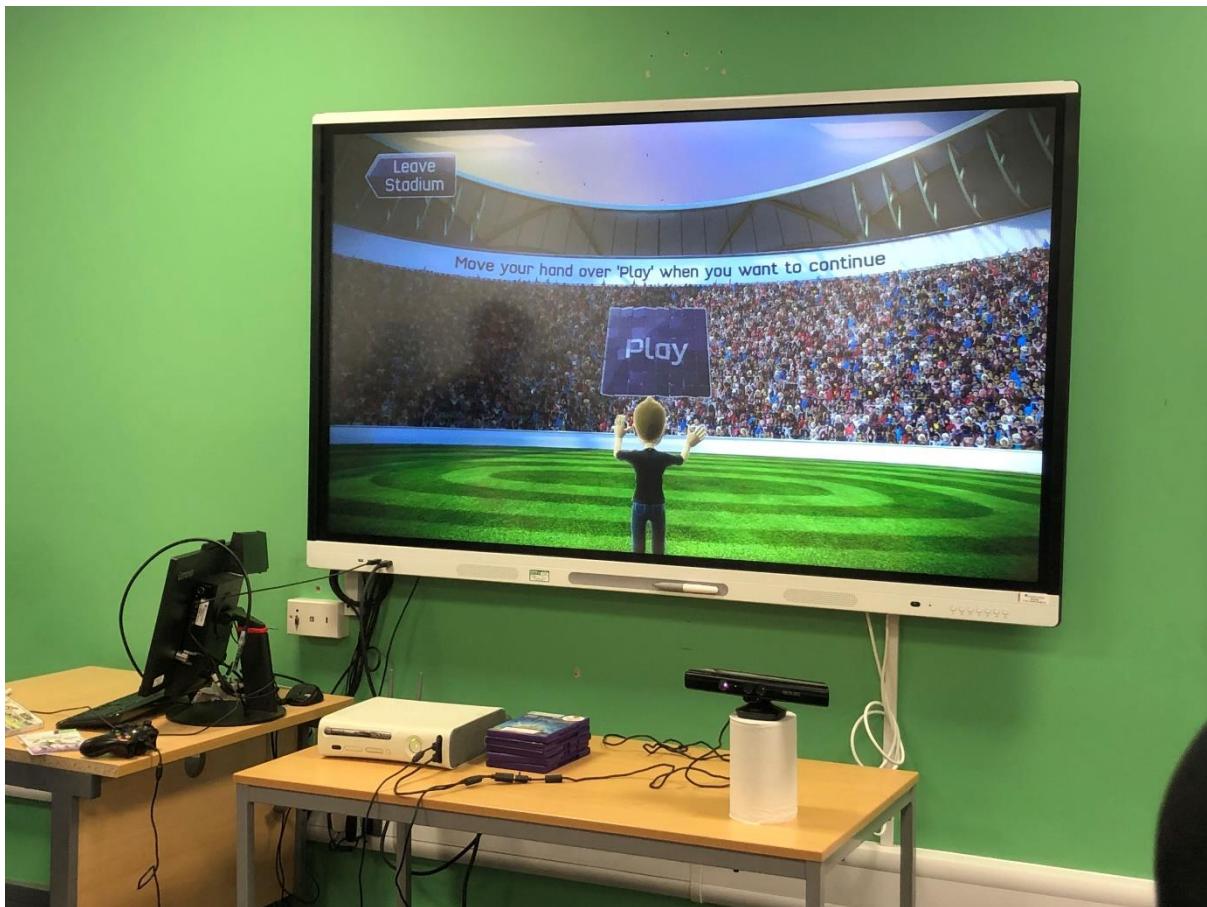


As the Xbox successfully connect to my network and connected to Xbox Live, we can now test our setup playing a Kinect supported game.

Step 8 – Insert the disc



Step 9 – Test the setup





After playing a few rounds of football which required me to kick as if I was really playing football, I was able to confirm that the setup was working as it was tracking my leg movement to a high degree of accuracy.

## History of Mobile Gaming

- The first game ever played on a mobile phone was in 1997 on the Nokia 6110 which played Snake!
- In 1998, Java was able to be put onto phones which meant that people could easily start to develop and create games for the phones that support Java.
- In 2003, Nokia released the N-Gage which was a handheld gaming device which sold over 400,000 sales during the first two weeks of being on sale. To play games you had to insert ink cartridges by taking off the entire back of the console
- In 2004, Nokia released the N-Gage QD which was an upgraded version of the classic N-Gage. It fixed all the issues with the previous N-Gage and made the screen slightly bigger with improved graphics.
- In 2007, Apple released the first iPhone which launched the App Store which meant developers could create and upload their games. As the iPhone could be used to make calls and texts as an actual phone, and because it was considered a ‘smart phone’, millions of people bought the phone which gave the game developers a huge platform to spread their game on. Games such as Flappy Bird, Angry Bird, Sketchman.
- In 2011, Sony released the Xperia Play which was a smart phone that had an extra ‘sliding out’ module that acted as a game pad to use when playing games. This was the successor to the PSP Go.
- In 2017, the first Razer Phone was released with 8GB of RAM, 64 GB of storage and had a Qualcomm Snapdragon 835 SoC. This was one of the first phones to have 120Hz display with variable refresh rate, meaning it changes based on what is happening on screen – for example when the phone is idling on the home screen the refresh rate could be 30hz, whilst in a game the refresh rate could be 120hz. This is also a massive battery life saver as the phone isn’t constantly running at 120hz.
- In 2018, Asus released the ROG2 phone running on a Qualcomm Snapdragon 855 SoC with up to 12GB of RAM and up to 1TB of storage. The phone had a 6.59” AMOLED display at 144hz. Some variants of the device come with a cooler that can clip onto the phone and use a small fan to blast air onto the device to help cool it down so it can run at faster speeds. This meant the phone could be even more powerful and run games at their full capability
- In 2020, XIAOMI released the Black Shark 3 Pro phone which included pop-up mechanical gaming buttons. The phone ran at a 90hz refresh rate and had a 7.1” AMOLED display
- In 2021, ZTE released the Nubia Red Magic 6 which contained a built-in air cooler with vents on the sides to take in and release air. This meant that the phone was always cooled and didn’t need any bulky accessories to get the maximum performance out of the device. However, this fan isn’t all good as it can use a lot of battery life and can cause vibrations and noise when in-use.



# Unit 36

Game Console Investigation

# Generation 1

1972-1984

# Magnavox Odyssey

(1972-1974)

- Specifications [1,2]
  - The console doesn't really have specifications as it will all be done with transistors, resistors and capacitors. The circuit cards alter the machine's signal path, which displays different light outputs on the TV. All the games are stored in the machine. Therefore the console has no memory or CPU (in a modern-sense).
- How to play a game [1,3]
  - To play a game, just insert the circuit cards and the machine will do the rest!
  - As there was no colour or graphics, you would need to put a plastic overlay over the TV screen to see them.
  - If the game is too slow for you, you can increase the ball's speed by turning the 'Speed' knob at the back of the console.
  - The games are 8-bit.
- Controllers [3]
  - The console supports up to two controllers. Each controller has a :
    - Horizontal knob (controls your light's horizontal position)
    - Vertical knob (controls your light's vertical position)
    - Reset button (if the ball goes out of the screen, it brings the ball back)
    - English knob (fits into the horizontal knob, controls the ball's direction)
  - The controllers are connected via a cable to the console.



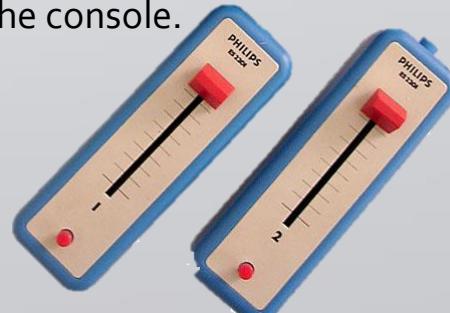
# Phillips Tele-Spiel ES 2210

(1973-1975)

- Specifications [1,3]
  - This also doesn't really have any specifications as everything is done via transistors, resistors and capacitors. Inside the game cartridges there are discrete components (like the ones list above) which have all the logic for the specific games on them. The main system is then used to display the game on the TV screen. Therefore, the console has no memory or CPU (in a modern-sense).
  - Games are 8-bit.

- Console [2,3]
  - There is no automatic scoring, so you have do use the slider on the console to keep track of scores.
  - There are 2 knobs:
    - Handicap (controls the difficulty level)
    - Kanal (controls the video canal used on your TV)
  - Connects to the TV via a coaxial cable.

- Controllers [2]
  - The controllers are plugged directly into the cartridges via a cable, instead of plugging them into the console.
  - Controllers have 2 features:
    - Slider (controls where the player is on the screen, vertical only)
    - Red Reset Button (brings the ball back into the game (pong))



# Generation 2

1976-1992

# Magnavox Odyssey<sup>2</sup>

(1978-1984)

- Specifications [1]
  - CPU – Intel 8048 8-bit microcontroller.
  - Memory – 64 bytes of RAM, 1 KB of ROM (additional ROM is in the game cartridges, typically 2-8 KB).
  - Graphics
    - Intel 8244 chip (or Intel 8245 for Europeans)
    - 160 x 200 resolution
    - 16-colour fixed palette
  - Sound – Intel 8244 chip (or Intel 8245 for Europeans). Mono audio only.
- Console [3,4]
  - Has a membrane keyboard on it! Has numeric, function, input, reset and alphabetic keys.
  - Connects to the TV via an RCA connector.
- Controllers [2,4]
  - Has a joystick design. (can go in 8 directions)
  - Only has 1 button, an “Action” button
  - The controller is hard-wired into the console. (however in the earlier releases of the console, you could unplug them)
  - Comes with 2 controllers



# Bally Astrocade

(1977-1983)

- Specifications [1,2]
  - CPU – Zilog Z80 (1.789 MHz)
  - Memory – 4 KB of RAM, 8 KB of ROM (additional ROM is in the game cartridges, typically 8 KB)
  - Graphics
    - Resolution – True 160x102 / Basic 160x88 / Expanded RAM 320x204
    - Bitmap graphic structure (allowed for 4 colour settings)
  - Sound – 0066-117XX sound chip (3 square wave channels, all with pitch accuracy of 8-bits)
- Console [3]
  - Has a membrane keypad
  - Has a slot for the game cartridges to be inserted to
    - With an eject and rest button
  - Slots at the top of the console to hold the games.
  - Often overheats and breaks easily.
- Controllers [2]
  - Has a joystick (can go in 8 directions)
  - Has a knob on the joystick which can move characters
  - A trigger on the back
  - Connected to the console via a cable.



# Generation 3

1983-2003

# Nintendo Entertainment System

(1983-1995)

- Specification [1,2,5,7]
  - CPU – Motorola 6502 8-bit (1.79 MHz)
  - Memory – 2 KB of RAM, 2 KB of Video RAM (in the Picture Processing Unit), 100+ KB of cartridge ROM
  - Graphics
    - 256x240 resolution
    - 52 colours
  - Sound – PSG sound chip (Programmable Sound Generator)
- Console [3,4,6]
  - Has a power and rest button on the front (power light will flash when a game is inserted) (power must be turned off in between games)
  - 2 slots at the front for controllers
  - A flap to insert game cartridges
  - At the side, there are the RCA connector ports (used to connect to the TV)
  - On the back, there are video ports and an AC adaptor port
- Controllers [3]
  - Has a joypad
  - Select and start buttons
  - A and B buttons
  - Connects to the console via cables.



# Sega Master System

(1985-1996)

- Specifications [1,2,36]
  - CPU - NEC 780C 8-bit (based on the Zilog Z80) (4 MHz)
  - Memory – 8 KB of RAM, 8 KB of ROM (up to 256 KB based on the built in game) (8 KB – 4 MB on cartridges), 16 KB Video RAM
  - Graphics
    - Sega VDP (Video Display Processor)
    - 256x240 resolution
    - 64 colours
  - Sound – Sega PSG (4 mono sound channels)
- Console [1,4]
  - There is a power, reset and pause button on the front of it, including a neat design on how the system works! Also has a flap at the top to insert game cards into.
  - Supports 2 controllers (2 ports on the front)
  - Supports card input
  - Connects to the TV via a RF out port on the back of console (incl. channel 3 and 4 support)
  - Powered by an AC adaptor
- Controllers [5]
  - Very similar to NES controllers
  - Has a joypad
  - A 1 and 2 button (1 is also bound to START, to pause a game, you have to use the button on the console)



# Generation 4

1987-2004

# Super Nintendo Entertainment System

(1990-2003)

- Specifications [1,2]

- CPU – Ricoh 5A22 16-bit (3.58 MHz) (this chip is a custom WDC 65C816 microprocessor)
- Memory – 128 KB of RAM, 64 KB of Video RAM for the PPU, 2+ MB of cartridge ROM
- Graphics
  - 512x448 resolution
  - 32768 colours (256 on screen)
- Sound – Sony SPC700 8-bit chip. Supported up to 8-channels.

- Console [3,4]

- At the front there are: 2 ports to plug your controllers into, a power switch, power indicator, reset button, eject button, a slot to insert the game cartridges.
- You can connect the console to the TV either via the MULTI out port (a cable that splits into RCA) or the RF port (which must be used with an RF switch). This is all found on the back of the console
- On the back, there is also the AC adapter for power.

- Controllers [1]

- Has a joypad
- Has a start and select button
- Has the A B XY button scheme that is used a lot today.
- Bumpers! We have a right and left bumper, along with a ZR and ZL buttons.



# Sega Genesis

(1988-1997)

- Specifications [1,2,3]

- CPU – Motorola 68000 16-bit (7.6 MHz)
- Co-processor – Zilog Z80 (controls PSG and FM chips, 4 MHz)
- Memory – 64 KB of RAM, 64KB of VRAM, 1 MB of ROM.
- Graphics
  - 320x240 resolution
  - 512 available colours (64 on screen)
- Sound – Texas Instruments PSG TI 76489 chip, Yamaha YM 2612 FM chip

- Console [4,5]

- At the front: there is an on/off switch, power led, volume slider, reset button, cartridge slot, 1/8 headphone jack used to connect audio to your TV through RCA, and 2 ports for controllers.
- You can connect the console to the TV via RF. Port fond on the back
- On the back, there are also an AC adapter, Sega A/V out, CH3-4 ports and a EXT port that isn't used.

- Controllers [1]

- Has a joypad
- Has a start and mode button
- Has grey X, Y and Z keys
- Has black A, B and C keys





# Generation 5

1993-2005

# Nintendo 64

(1996-2002)

- Specifications [2,3]
  - CPU – NEC VR4300 64-bit (93.75 MHz)
  - Memory – 4.5 MB of RAM (0.5 for anti-aliasing)
  - Graphics
    - 256x224 resolution
    - 16.7 million colours (32,768 on screen)
  - Sound – 16-bit stereo (has CD quality)
- Console [4,5]
  - On the front: a power switch, reset button, memory expansion slot, cartridge slot and 4 controller ports.
  - Connects to the TV via a MULTI OUT connector which splits into RCA cables. The port is found on the back of the console
  - On the back, there is the MULTI OUT connector and the AC adapter for power.
- Controllers [1]
  - Has a joypad
  - Has a joy stick
  - Has a red start button
  - Has A and B buttons, along with 4 C buttons



# PlayStation

(1994-2006)

- Specifications [2,3,4]

- CPU – RISC MIPS R3051 32-bit (MIPS R3000A-compatible, 33.8688 MHz)
- Memory – 2 MB of RAM, 1MB of VRAM, 512 KB of ROM
- Graphics
  - 256x224 to 640x240 resolution
  - 16,777,216 colours (57,344 (256x224) to 153,600 (640x240) on screen
- Sound – 16-bit, 24 channel PCM (Pulse-Code Modulation)

- Console [5]

- On the front there is: a power switch and led, a reset button, a open button (which opens an optical drive where you can put your games :O) and 2 controller ports
- Connects to the TV via a MULTI OUT connector which splits into RCA cables. The port is found on the back of the console
- On the back, there is a AC adapter, MUTLI-OUT port and a SERIAL I/O port.

- Controllers [1,6]

- Has a joypad (to an extend)
- A select and start button
- The triangle, circle, X and square buttons seen on all of the PlayStations
- Shoulder buttons



# Generation 6

1998-2013

# Xbox

(2001-2009)

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- Specifications [2,3]

- CPU – Custom Intel Pentium III Coppermine-based 32-bit (733 MHz)
- Memory – 64 MB of RAM
- Graphics
  - Supports 480i, 480p, 576i, 576p, 720p and 1080i resolution
  - GPU – Used a 233 MHz NV2A ASIC (by NVIDIA)
- Sound – NVIDIA MCPX, 64 3D sound channels



- Console [1,4]

- On the front, there is a power button, a disc eject button, a disc drive, 4 controller ports
- It connects to the TV via a proprietary AV connector which splits into regular RCA
- On the back, there is a AC power adapter, AV connector and a ethernet port!

- Controllers [5]

- Has 2 joysticks
- Has a d-pad
- Has A, B, X, Y, Black and White buttons
- Has 2 triggers.



# GameCube

(2001-2007)

- Specifications [2,3]

- CPU – Custom IBM Gekko PowerPC, 128-bit (485 MHz)
- Memory – 24 MB of SRAM (for the main system), 16MB of DRAM (used as I/O buffer for audio and dvd drive), 3 MB of VRAM
- Graphics
  - Supports 480i, 480p and 576i resolutions
  - 16.7 million colours on screen
  - 20 million polygons per second
- Sound – 16-bit Macronix DSP Sound Processor (64 voices)

- Console [4]

- On the front, there is 4 controllers ports, and 2 memory expansion ports. On the top, there is the CD drive, a power, reset and open button.
- You can connect to the TV via a MUTLI OUT cable which splits to RCA, or use a RF Modulator with an RF switch.
- On the back, there is the AC power adapter, analog av out and digital av out.

- Controllers [1,5]

- Has 2 joysticks
- Has a d-pad
- Has the usual A, B, X, Y buttons
- A start/pause button
- Has 2 triggers and a right bumper





# Generation 7

2005-2017

# Wii

(2006-2017)\*

- Specifications [1,2]

- CPU – IBM Broadway (729 MHz)
- Memory – 88MB of RAM
- Graphics
  - ATI Hollywood GPU (243 MHz)
  - 408p resolution
- Sound – Dolby Pro Logic II (Stereo)
- Connectivity – Wireless IEEE 802.11 b/g (WiFi)

- Console [3]

- On the front, there is a power, reset, eject, disc slot and a sd card slot. On the top there is GameCube controller ports and memory expansion slots.
- It connects to the TV via a MULTI OUT port which splits into RCA.
- On the back, there is also an AC adapter, sensor bar port and 2 USB 2.0 ports.

- Controllers

- See next slide.



# Wii

## Controllers

- Wiimote (Main Controller) [3]
  - Rectangular shape
  - Has a joypad
  - A button on the front
  - -, Home + buttons
  - 1 and 2 button.
  - B trigger on the back
- Nunchuk Addon [3]
  - Has a joystick
  - C bumper
  - Z trigger
- Classic Controller [3]
  - Has a joypad and 2 joysticks
  - - (select), Home and + (start) buttons
  - A, B, X, Y buttons
  - Left and Right trigger
  - Left and Right bumper



The Nunchuk and Classic Controller both connect to the Wiimote [3]

The Wiimote connects to the console via Bluetooth [1]

Through use of built-in accelerometers and infrared detection to sense its position in a 3D space when pointed at the LEDs in the Sensor Bar [1]

# PlayStation 3

(2006-2017)

- Specifications [2,3,4]

- CPU – Cell Broadband Engine (3.2 GHz)
- Memory – 256 GB of RAM, 256 GB of VRAM
- Graphics
  - NVIDIA RSX GPU
  - 1920x1080 max resolution
- Sound – Dolby 5.1ch, DTS, LPCM, etc (Cell-base processing)
- Connectivity – WiFi IEEE 802.11 b/g, Bluetooth 2.0 (EDR (Enhanced Data Rate))

- Console [1,2]

- On the front, there is a power button, eject button and a dvd drive.
- The PS3 connects to the TV via HDMI OUT or via a MULTI OUT port which splits into RCA. (first console to have a HDMI port!)
- On the back, there is an ethernet port, HDMI OUT, DIGITAL OUT, MUTLI OUT and a AC power adapter

- Controllers [5]

- Motion sensing (3 axes, 6 degrees of movement)
- 2 joysticks (both are pressure sensitive and count as a button)
- 2 triggers, 2 bumpers
- Triangle, Circle, X and Square buttons
- Start, Select and PS button



# Generation 8

2011-2019

# Nintendo Switch

(2017-present)

- Specifications [2,3]

- CPU – NVIDIA Custom Tegra processor
- Memory – 32 GB of RAM
- Graphics
  - NVIDIA Custom Tegra processor
  - Multi-touch screen, 6.2 inc LCD, 1280x720 resolution
- Sound – Stereo Speakers (headphones -> Stereo Outpust)
- Connectivity – WiFi IEEE 802.11 a/b/g/n/ac, Bluetooth 4.1 (NCF (near field communication))

- Console [1]

- On the front, you find the 6.2 inc LCD screen, and often the 2 joy con controllers on each side.
- It connects to the TV via... wait, no, it doesn't. Use the dock to do that! (hdmi)
- On the top, there is a power button, volume control, headphone jack and game card slot.
- On the bottom, there is a USB-C power port.

- Controllers

- See next slide



# Nintendo Switch

## Controllers

- Joy-Con [1]
  - The good ol' red 'n' blue design.
  - On the red (left), there is a joystick, up, down, left and right buttons, a square button, a minus button, along with a trigger and bumper
  - On the blue (right), there is also a joystick, A, B, X, Y buttons, a home button, a + button, and a trigger and bumper
- Pro Controller [1]
  - The more conventional controller, and its optional.
  - Has 2 joysticks
  - Has a dpad
  - A, B, X, Y, +, - buttons
  - A square and home button
  - 2 triggers and bumpers



# Xbox One

(2013-2016)

- Specifications [1,2]

- CPU – Custom AMD CPU with 8 cores (1.75 GHz)
- Memory – 8GB of RAM, 32MB of SRAM on the graphics die
- Graphics
  - Durango GPU
  - Supports 1080p and 720p resolutions
- Sound – Dolby Atmos, 7.1 surround sound
- Connectivity – WiFi a/b/g/n dual-band (2.4 GHz and 5 GHz), Gigabit Ethernet and WiFi Direct 17

- Console [2]

- On the front, there is a power button, USB 2.0 port, eject button and a dvd drive
- Connects to the TV via HDMI out
- On the back, there is an AC power adapter, HDMI IN and OUT, 2 USB 3.0 ports, ethernet port, Kinect port, IR OUT, and Optical Audio Out

- Controllers [1]

- 2 joysticks
- A dpad
- A, B, X, Y and 2 misc buttons
- 2 triggers and bumpers





# Generation 9

2020-present

# PlayStation 5

(2020-present)

- Specifications

- CPU – AMD Ryzen Zen @ 3.5 GHz with 8 cores
- Memory – 16 GB GDDR6 @ 448 GB/s
- Graphics
  - AMD Radeon RDNA 2-based engine
  - Uses Ray Tracing Acceleration @ up to 2.23 GHz / 10.3 TFLOPS
- Sound – “Tempest” 3D AudioTech
- Connectivity – WiFi IEEE 802.11a/b/g/n/ac/ax, Bluetooth 5.1 and Ethernet

- Console [1,2]

- On the front of device, there is a power button, disk drive, a USB-A ‘Hi-Speed’ port and a USB-C ‘Superspeed’ at 10 Gbps port
- At the back there is 2 x 10 Gbps USB-A ports, an ethernet port, a HDMI 2.1 port for video out of up to 4K 120Hz and a power connector

- Controllers [3]

- Motion detection via a 3-axis gyroscope and a 3-axis accelerometer and vibration
- 2 pressure sensitive joysticks
- Usual action buttons (the shapes!)
- Usual shoulder and triggers (however the triggers now have pressure detection and can stop players from pushing down on them during certain scenarios)
- Capacitive touchpad with 4 different corner buttons
- Options button merged from START and SELECT



# Xbox Series X

(2020-present)

- Specifications [1]
  - CPU – AMD Zen 2 @ 3.8 GHz with 8 cores
  - Memory – 16 GB of GDDR 6 @ 560 GB/s
  - Graphics
    - AMD Radeon RDNA 2-based engine
    - Runs at 1.825 GHz / 12 TFLOPS
  - Sound – Dolby Digital 5.1, DTS 5.1 and Dolby TrueHD with Atmos
  - Connectivity – WiFi 802.11ac, Ethernet 802.3
- Console [2,3]
  - At the front of the console, there is a disk drive with an eject button, and the power button with an Xbox logo as a power LED
  - At the back, there is an HDMI OUT 2.1 port, 3 x USB-A 3.1 ports, ethernet port, storage expansion slot and a power connector
- Controllers [4,5]
  - There are many different controller variants, from the core wireless controller to the eliete controller, there is a controller for everyone's needs
  - All the controllers have the usual AB XY buttons, 2 pressure sensitive joysticks, a D-pad and a view, share and menu button, along with 2 shoulder buttons and 2 triggers





# Unit 36

PC Gaming Investigation



The 1980s

# Commodore 64

(1982)

- Specifications [1,4]
  - CPU – MOS Technology 6510 @ 0.985 MHz, VIC II for video and SID for sound (co-processors)
  - Memory – 64 KB of RAM and 20 KB of ROM
  - Graphics:
    - 16 colours + 16 border colours
    - 320 x 200 resolution
  - Sound – 3 voices across 9 octaves
- Computer [2,3]
  - The computer comes built inside of a keyboard, from which a monitor, controllers and similar items can be plugged into it. This keyboard is used to play some of the games and enter commands into the console.
  - On the side of the computer there is 2 controller ports, a power button and power jack.
  - On the back there is a cartridge slot, TV RF jack, A/V jack for audio or a monitor, a serial port, cassette port and a “user port” which is freely programmable for cartridges or interface cards.
- Controller [5]
  - The C64 takes input from a joystick like controller that contains: 4-directional joystick, 2 fire buttons and 8 other programable buttons
  - The computer’s keyboard can often be used as input for some of the games on it



# Atari ST

(1985)

- Specifications [1,2]

- CPU – Motorola 68000 @ 8 MHz
- Memory – 512 KB of RAM and 192 KB of ROM
- Storage – 360 KB floppy disk drive
- Graphics
  - 60 Hz display
  - 3 levels of resolution – low at 320x200 with 16 colours and a palette of 512, medium at 640 x 200 with 4 colours and a palette of 512 colours, and high with 640x400 with monochrome colours
- Sound – 3 voices across 8 octaves



- Computer [3]

- Similar to the C64, the computer was built into a keyboard, meaning you would need to buy a monitor to go with it, including any peripherals such as a mouse.
- On the side of the computer, there is a midi in and out port, a slot to plug your game cartridge into and 2 slots for peripherals.
- On the back, there is ports for: a modem, printer, hard disk, floppy disk, TV, monitor, an on-off switch, a reset button and a power connector.

- Controller [1]

- One of the most loved controllers for the AST is the Mindscape Powerplay Joystick. Mice are also often commonly used.
- This has a joystick and pistol-like trigger button, the joystick can move in 4 directions.





The 1990s

# Amiga 4000

(1992)

- Specifications [1]

- CPU – Motorola 68EC030 / 88040 @ 25 MHz
- Memory – 2 MB of RAM on the board with up to 16 MB additional, 512 KB of ROM
- Graphics:
  - Amiga Advanced Graphic Architecture
  - 24-bit colour palette (16.8 million colours)
  - 256 on-screen colours in indexed mode with 144 colours in HAM-8 mode
  - Supported resolutions of 320x256 to 1280x512 in PAL and 640x480 using VGA
- Storage – 120 MB IDE HDD (which is upgradeable) and has a 1.76 MB removable floppy drive
- Sound – 4 of 8-bit PCM channels with a maximum of 56 kHz DMA sampling rate

- Ports and Expansions [1]

- In-terms of IO, the computer has: an analogue RGB video out, 2 x audio out (RCA), keyboard (6 min mini-DIN), 2 x mouse/gamepad (DE9), RS-232 serial ports (DB-25M), parallel port (DB-25F), floppy disk drive (DB-23F), ATA controller (40-pin)
- In-terms of expansion, the computer has: 4 x 100 pin Zorro 3, an AGA video, 3 x 16-bit ISA, 200-pin CPU expansion, 4-5 x 72-pin SIMM

- Physical Layout [2,3]

- The machine has 15 x 5 x 15 1/4" inch dimensions in W x H x D
- At the front of the machine, there is a DVD drive and floppy disk drive
- At the back there is a power port; serial, parallel and floppy expansion; keyboard, video and audio ports



# iMac G3

(1999 – 2<sup>nd</sup> generation)

- Specifications [1]

- CPU – PowerPC 750 @ 400 MHz
- Memory – 64 MB of PC100 SDRAM, expandable to 1GB – 64 KB of L1 cache and 512 KB of L2 cache
- Graphics:
  - ATI Rage 128 VR
  - 8 MB of SDRAM
  - 15-inc CRT display
  - 1024 × 768 resolution
- Storage – 6, 10 or 13 GB HDD @ 5400-rpm

- Ports and Connectivity [1]

- In-terms of IO, the computer has: 2 x USB-A 1.1, 2 x FireWire 400, 2 x headphone mini-jacks, analogue audio input mini-jack and a CD/DVD drive
- In-terms of connectivity: an optional 11 Mbit/s AirPort 802.11b (for WiFi, adapter required), 10/100 BASE-T ethernet and a 65k V.90 modem

- Physical Layout [1,2]

- The machine has 15 x 15 x 17.1 inch dimensions in W x H x D
- At the front of the machine, there is the CD/DVD drive, speakers, audio jacks and the power button
- At the side there is: audio in and out, FireWire, Modem, USB, Ethernet and the reset programmer switch





The 2000s

# Power Mac G3

(2003)

- Specifications [1]

- CPU – PowerPC 970 @ up to 2 GHz dual core
- Memory – 512 MB of PC-3200 DDR SDRAM, expandable up to 8GB
- Graphics:
  - ATI AMD Radeon 9800 Pro
  - Up to 256 MB of DDR VRAM
- Storage – up to a 250 GB HDD @ 7200-rpm

- Ports and Connectivity [1]

- In-terms of IO, the computer has: 3 x USB 2.0, 2 x FireWire 400, a FireWire 800, audio-in mini-jack, 2 x audio-out mini-jack and a DVD drive
- In-terms of connectivity: AirPort Extreme 802.11b/g (optional, external antenna needed), a gigabit ethernet and Bluetooth 1.1 (optional)

- Physical Layout [2,3]

- The machine has 8.1 x 20.1 x 18.7 inch dimensions in W x H x D
- At the front of the machine, there is an optical drive, power button / status light, headphone jack, a USB-A 2.0 and a FireWire 400
- At the side there is AirPort antenna, Bluetooth antenna, digital audio in / out, analogue audio in/out, 2 x USB-A 2.0, FireWire 400, FireWire 800 and an ethernet port



# Dell XPS 730X

(2008)

- Specifications [1]

- CPU – Intel Core i7 920 @ 2.66 GHz, 4 cores
- Memory – 3 GB of DDR3 RAM, with a maximum of 6 GB
- Graphics [2]:
  - ATI AMD Radeon HD4850, running on a PCIe 2.0 16x slot
  - 512 MB VRAM GDDR3
  - Resolution of up to 1600x900
- Storage – 320 GB SATA HDD

- Ports and Connectivity [1]

- In-terms of IO, the computer has: 8 x USB-A 2.0, an eSATA, PS2, microphone in (3.5mm), audio out (3.5mm), and a DVD drive
- In-terms of connectivity: a FireWire IEEE 1394 and 1000 mbps Ethernet

- Physical Layout [1,3]

- The machine has 8.6 x 21.9 x 23.4 inch dimensions in W x H x D
- At the front of the machine, there is 2 USB-A, FireWire, audio in and audio out and a DVD drive
- At the back there is 6 USB-A, eSATA and PS2, audio in and out and ethernet





The 2010s

# Microsoft Surface Studio

(2016)

- Specifications [1]
  - CPU – 6<sup>th</sup> Generation Intel Core i7
  - Memory – up to 32 GB of RAM
  - Graphics:
    - NVIDIA GeForce GTX 980M
    - 4GB of GDDR 5 VRAM
    - 4500 x 3000 resolution
    - 28" touchscreen display
  - Storage – Hybrid drive setup (uses both an SSD and HDD) with up to a 128 GB SSD and a 2 TB HDD
- Ports and Connectivity [1]
  - In-terms of IO, the computer has: 4 x USB-A 3.0, full-size SD card reader and a 3.5mm headset combo jack
  - In-terms of connectivity: 1 gigabit ethernet port and WiFi 802.11ac, IEEE 802.11a/b/g/n, Bluetooth 4.0 and Xbox wireless
- Physical Layout [1]
  - The machine has a 12.1 x 17.3 x 0.5 inch display and 9.8 x 8.7 x 1.3 inch base dimensions in W x H x D
  - At the front of the machine, there is a 1080p camera compatible with Windows Hello
  - At the side there is a volume and power button, with the back having 4 USB-A, ethernet, power connector, mini DisplayPort, SD card reader and audio in/out



# iMac Pro

(2017)

- Specifications [1]

- CPU – up to 18-core Intel Xeon @ 4.3 GHz Boost
- Memory – between 32 and 256 GB of DDR4 ECC SDRAM
- Graphics:
  - AMD Radeon Pro Vega 56, 64 or 64X
  - Up to 16 GH MBM2 VRAM
  - 5120 x 2880 resolution
  - 27" LED display at 60 Hertz
  - 1.07 billion colours
- Storage – between 1 TB and 4 TB SSD

- Ports and Connectivity [1,2]

- In-terms of IO, the computer has: 4 x USB-A 3.0, 4 x Thunderbolt 3, SD card reader, headphone combo jack and support for up to 4 external displays
- In-terms of connectivity: Internal WiFi 802.11a/b/g/n/ac, 10 gigabit ethernet and Bluetooth 5.0

- Physical Layout [2]

- The machine has 25.6 x 20.3 x 65.02 inch dimensions in W x H x D
- At the front of the machine, there is a 1080p HD FaceTime camera
- At the back there is the headphone jack, SD card reader, 4 USB-A and 4 Thunderbolt 3 and an ethernet port





The 2020s

# M1 Mac mini

(2020)

- Specifications [1]

- CPU – Apple M1 chip with 8 CPU cores (4 performance, 4 efficiency) and 16-core neural engine
- Memory – 8-16 GB of unified memory
- Graphics:
  - Apple M1 chip with 8 GPU cores
  - Uses the unified memory as VRAM
  - Support for up to 2 monitors, 1 at 6K and the other at 4K via HDMI
- Storage – 256 GB - 2 TB SSD

- Ports and Connectivity [1]

- In-terms of IO, the computer has: 2 x Thunderbolt 4, 2 x USB-A 3.0, HDMI 2.0, Gigabit-10Gb ethernet, 3.5mmmm headphone jack
- In-terms of connectivity: WiFi 6 802.11ax & IEEE 802.11/a/b/g/n/ac, Bluetooth 5.0

- Physical Layout [1]

- The machine has  $7.7 \times 1.4 \times 19.3$  inch dimensions in W x H x D
- At the front of the machine, there is the power indicator
- At the back there is all of the IO and connectivity mentioned above, and the power button and connector



# MSI MEG Aegis Ti5

(2021)

- Specifications [1]
  - CPU – 10<sup>th</sup> Generation Intel i9-10900K
  - Memory – up to 128 GB of DDR 4 RAM
  - Graphics:
    - Up to a MSI GeForce RTX 3080
    - Max option has 10 GB GDDR6X VRAM
  - Storage – configurable to user's like, the machine has: 3 x M.2 SSD slots, 2 x 2.5" drive bays and a 3.5" drive bay
- Ports and Connectivity [1]
  - In-terms of IO, the computer has: 2 x USB-A 2.0, 5 x USB-A 3.2, 2 x USB-C 3.2, thunderbolt 3, PS2, HDMI out, 5 x audio jacks, a mic-in and headphone out
  - In-terms of connectivity: a 2.5G and a gigabit ethernet port, and Intel WiFi 6 AX2021, Bluetooth 5.1
- Physical Layout [1]
  - The machine has 551, 511, 239 millimetre dimensions in W x H x D
  - At the front of the machine, there is USB-C, 2 USB-A, mic-in and headphone-out
  - At the back there is everything mentioned in the IO and connectivity list above





# Unit 36

Arcade Machine Investigation

# Early History

1971-1977

# The First Machines

(1971-1974)

- In **1971** at Stanford University in California<sup>[2]</sup>, 2 students using a PDP-11 based machine which contained a series of 16-bit minicomputers<sup>[3]</sup> released a clone of "Spacewar!" called **Galaxy Game**.<sup>[1]</sup> However, this machine wasn't commercialised and wasn't widely used
- Later in the year, Syzygy Engineering launched the game **Computer Space**, which was the first commercial video arcade game.<sup>[1]</sup>
- In **1972**, Atari released **Pong**. It was considered the first 'commercially successful' game and the first sports video game.<sup>[1]</sup>
- Later in **1974**, Taito released **Space Race**, which was controlled via a racing wheel and introduced scrolling sprite graphics.<sup>[1]</sup>



# Getting the Ball Rolling

(1975-1977)

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- In 1975, Midway MFG released the first arcade game to use a microprocessor which allowed for smoother animations and improved graphics: **Gun Fight**. <sup>[1]</sup>
- The first ever first-person racing game with 3D graphics was released: **Nürburgring 1** by Dr Reiner. <sup>[1]</sup>
- Atari starts to ramp up their production by releasing 4 new games: **Hi-way**, **Crash 'N Score**, **Indy 800** (included with overhead mirrors on the cabinet so spectators can watch the game) and **Steeplechase** <sup>[1]</sup>
- In 1976, Sega enters the scene and released **Moto-Cross** which was the first game to use haptic feedback on the game's handlebars during a collision. Sega later released **Heavyweight Champ** which was the first game to feature hand-to-hand fighting. <sup>[1]</sup>
- Atari continues pushing out new games with **Night Driver** (a FP racing game) and **Breakout**. <sup>[1]</sup>
- Exidy releases **Death Race**<sup>[1]</sup>, which was a game to “inspire protest and cause panic”. <sup>[2]</sup>
- Gremlin releases **Blockade** which used mechanics seen in the game “Snake”. <sup>[1]</sup>

# The Golden Era

1978-1986

# ◆ Early Golden Era ◆

(1978-1981)

- Causing the start of the golden area in **1978** – Taito releases **Space Invaders** which is the first blockbuster arcade game and has influenced most shooter games released since. <sup>[1]</sup>
- In **1979** Atari releases **Asteroids** which is their best setting game of all time. <sup>[1]</sup>
- Namco later releases **Galaxian** which is the first game to use RGB colour. <sup>[1]</sup>
- In **1980**, the first game to include voice synthesis was released: **Speak & Rescue** by Sun Electronics. <sup>[1]</sup>
- Namco later releases **Pac-Man**, one of the most influential games of all time and was one of the first games to use power-ups and cutscenes. <sup>[1]</sup>
- Data East released the first standardized platform: the **DECO Cassette System** which many future games were made for. <sup>[1]</sup>



# ✨ Late Golden Era ✨

(1982-1986)

- In 1981, Nintendo enters the industry with **Donkey Kong** – one of the first platformer games. <sup>[1]</sup>
- Konami later released **Scramble** which was one of the first side-scrolling shooter and multiple distinct levels. <sup>[1]</sup>
- In 1982, Namco releases **Pole Position**, which was the first 16-bit video game. <sup>[1]</sup>
- In 1983 the first game to use digitized sprites is released: **Journey** by Bally Midway. <sup>[1]</sup>
- Atari releases an arcade version of **Star Wars** as a 3D vector graphics simulation. <sup>[1]</sup>
- In 1985 Nintendo releases **Vs Super Mario Bros** – the arcade version of Super Mario Bros. <sup>[1]</sup>
- In 1986, Exidy releases **Chiller** – one of the first times blood and gore is seen in an arcade game. <sup>[1]</sup>
- Vidiid Group later releases the first ‘virtual reality’ arcade game to use 3D polygon graphics: **Turbo Kourier**. <sup>[1]</sup>



# Post-Golden Era

1987-present

# The End

(1987-present)

- As time progressed, Arcades became less and less popular, especially with the introduction of PC gaming and console gaming. Depending on the area, Arcades still do exist and operate today but with no where near the popularity they used to have.
- Games such as Street Fighter and Mortal Combat were released during this period which helped maintain some popularity, but as these titles started getting ported to different platforms their popularity once again decreased





# Unit 36

TV Gaming Investigation

# Plug and Play

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- Plug and Play are devices that can be directly plugged into a TV and can be used to play a game – for example Pong!
  - These devices are usually built inside controllers to keep clutter down.
  - The first plug and play devices were seen around the mid 1990s when the Retro Game movement started to gain more popularity
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- Using a HDMI signal, the PnP games do all the processing for the game on its own compute unit. It is essentially a single-game console that has everything build inside of it.



# Ceefax and Teletext

- Ran by BBC and ITV, Ceefax and Teletext were primarily for seeing the current news, listening to the radio, booking flights and much more.
- These systems also included a couple, very basic games. These games could be accessed and played just like they were a TV channel.
- Ceefax was able to play the following: Howlers, Dotty Trees, Loony Limericks, Reg's Tale, Tee Hee, Figure It Out, Daft Definitions and Riddler's. When you selected a game, it would briefly show you a description of the game before it begins. The games are controlled via the remote controller.
- Teletext was able to play: Bamboozle, Competition, Children, Digitiser, Chess and Bridge. Similarly to Ceefax, the game's description will be shown before you can play.
- For both systems, you select the game through typing it's number at the top left search box.



# Smart TVs

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- Most modern smart-tvs include app stores, from which games can usually be downloaded
  - Some TVs run off Android TV, meaning they can play supported games directly off of the Play Store
  - This works similarly with Apple TV as you can download apps from the App Store on that.
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- However Android TV and Apple TV vary in how they operate: Android TV is usually baked into TVs and is the primary operating system for the TV. However, Apple TV comes as a separate box that must be plugged into a TV through HDMI.

