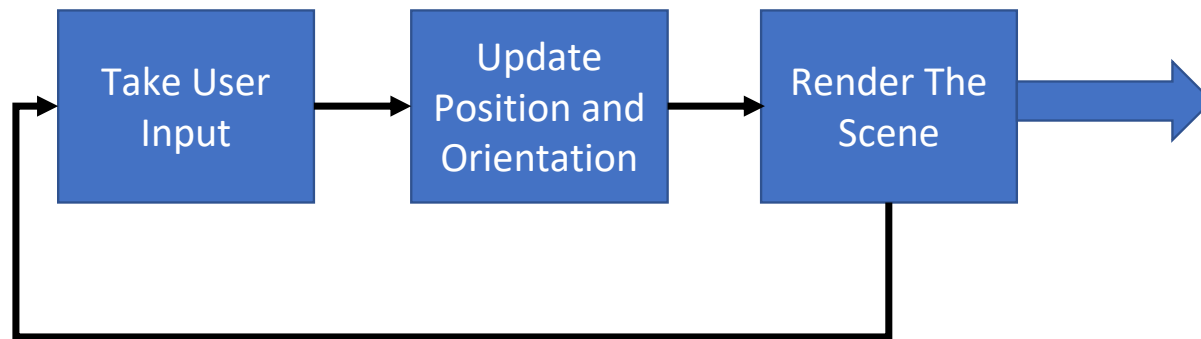


# Game Programming

# Our Road Map

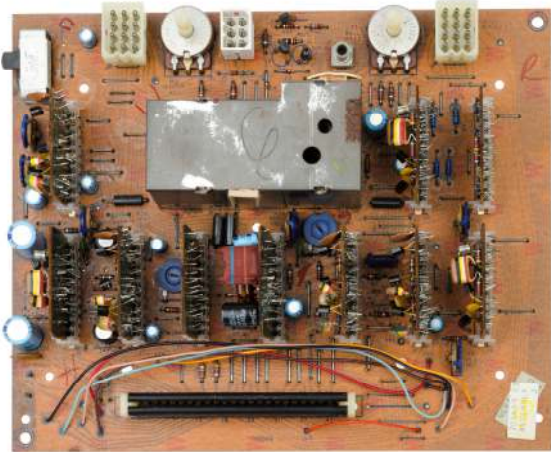
- How Game Works
- History Tour
- Todays Game Market
- Game Programming Jobs
- Game Development Tools

# How A Game Work



# Video Games History – First Generation

- Magnavox Odyssey

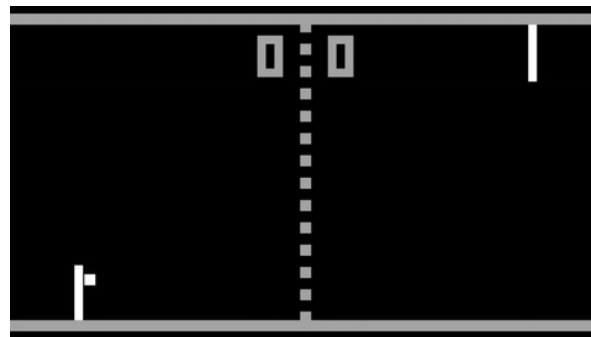


350,000 SOLD World Wide



# Video Games History – First Generation

- Pong Machines



# Second Generation Consoles

- Atari 2600



**CPU**

**128 bytes RAM**

**1.19 Mhz MOS 6507**



# Game Cartridges



# Atari 2600 Games



**Pitfall**  
**First Platformer**



**E.T.**  
**Worst Game Ever**



**Space Invader**  
**It's just a game**

# Development Tools

- 6502 Assembly Language

The screenshot displays a development environment for 6502 assembly language. The main window shows the source code for a file named '32KGame20180101p.asm'. The code includes labels for 'GameStateLo:', 'GameStateHi:', 'BankJump:', 'TitleScreenLogic:', 'CreditScreenLogic:', and 'LeadIn...Logic:'. Each label contains a series of '.byte' instructions and assembly instructions like 'lda', 'sta', 'dec', 'bne', 'inc', 'jmp', and 'nop'. A yellow highlight is visible on line 208.

On the right side, there is a disassembly window showing the corresponding machine code. The disassembly includes instructions such as 'LDA GameStateHi.Y', 'STA ram\_85', 'JMP.ind (Game\_JumpInd)', and 'BNE VWait'. The address column shows values like 89, 85, 6C, 78, and 83. The disassembly window also shows a memory dump at the top with hexadecimal and binary values.

Address	Instruction	Comment	Hex
F066	LDA	GameStateHi.Y	:4 89 72 F0
F069	STA	ram_85	:3 85 85
F06B	JMP.ind	(Game_JumpInd)	:5 6C 84 00
GameStateLo	.byte	\$78	78
	.byte	\$89,\$9A,\$AB	
GameStateHi	.byte	\$F0	F0
	.byte	\$F0,\$F0,\$F0,\$0C,\$F0	
TitleS...nLogic	LDA	CXBLPF1\$70	:3 A5 76
F07A	STA	Game_JumpInd	:3 85 84
F07C	LDA	ram_F1	:3 A5 F1
F07E	STA	ram_85	:3 85 85
TakeUpLoop	DEC	ScratchRAM	:5 C6 88
F082	BNE	VWait	:2 D0 33
F084	INC	GameState	:5 * E6 83
SnSPFGraphics	JMP	VWait	:3 * 4C B7 F0
Credit...nLogic	LDA	CXBLPF1\$70	:3 * A5 76
F08B	STA	Game_JumpInd	:3 * 85 84
F08D	LDA	ram_F1	:3 * A5 F1
F08F	STA	ram_85	:3 * 85 85
F091	DEC	ScratchRAM	:5 * C6 88
F093	BNE	VWait	:2 * D0 22
F095	INC	GameState	:5 * E6 83
TitleT...aphics	JMP	VWait	:3 * 4C B7 F0
LeadIn...lLogic	LDA	CXBLPF1\$70	:3 * A5 76



# Game Computers



Commodore 64

Mos 6502 1 Mhz CPU



Zx Spectrum

Z801 3.5 Mhz CPU



Amstrad CPC464

Z801 3.5 Mhz CPU

# Commodore 64 (1982)

- About 17 Million units Sold
- Most popular computer of all time.



Tape Drive



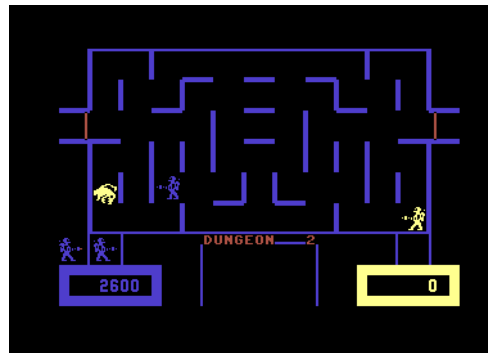
Serial Port



# Games



International Karate



Wizard of Wor



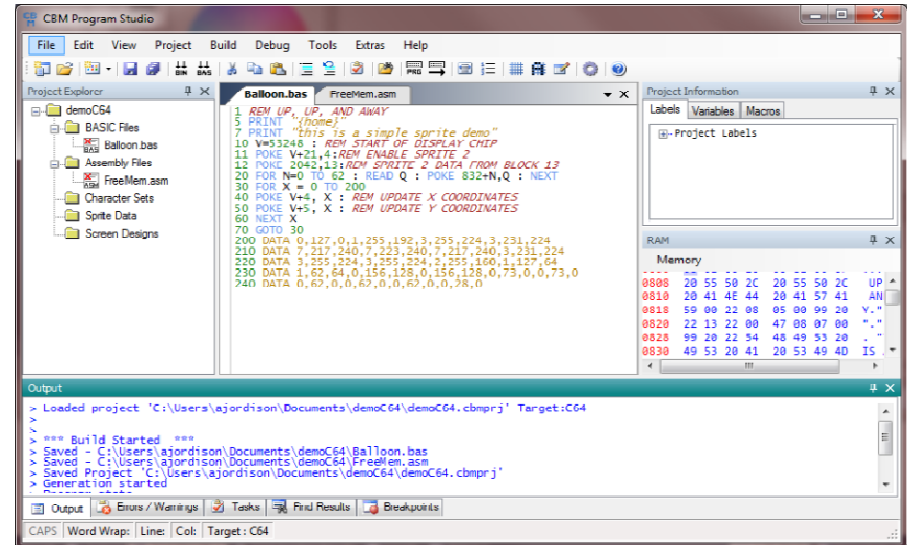
Rick Dangerous



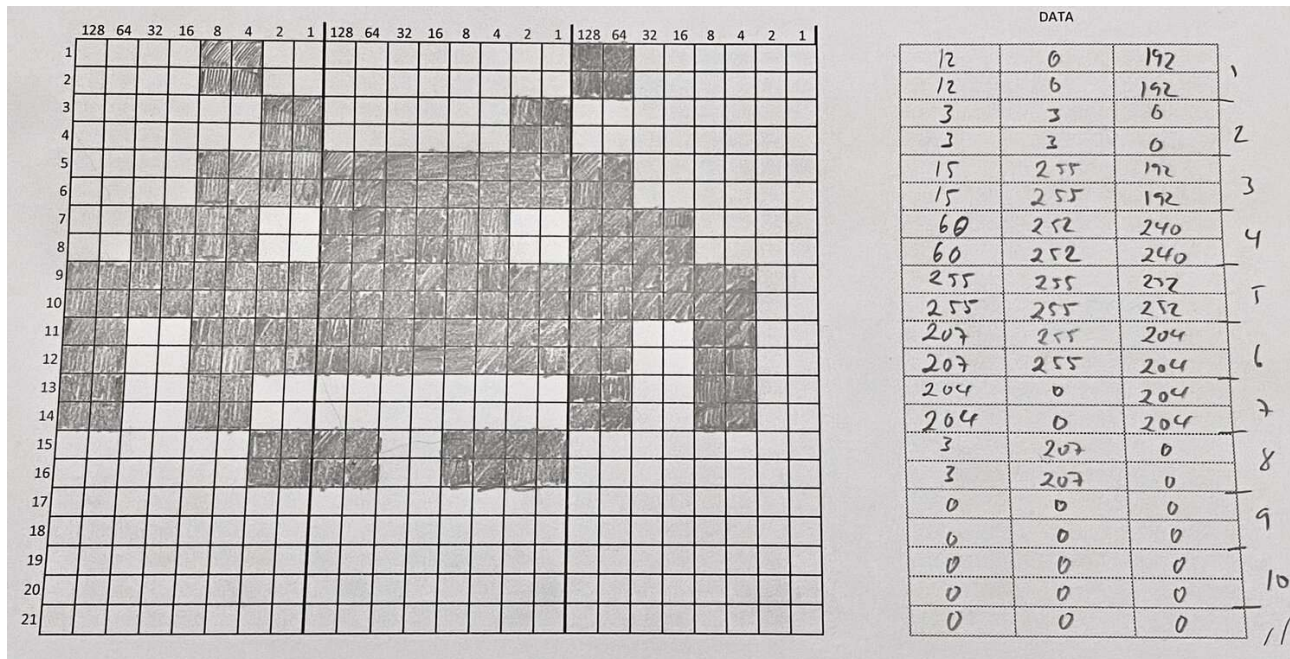
# Development Tools

- Basic Language
- 6502 Assembly Language

```
***** COMMODORE 64 BASIC V2 *****
64K RAM SYSTEM 38911 BASIC BYTES FREE
READY.
LOAD"ADDRESS FINDER",8,1:
SEARCHING FOR ADDRESS FINDER
LOADING
READY.
RUN
FILENAME? ASSEMBLER
LOAD ADDRESS: I.....2049
LOW BYTE: I.....0
HIGH BYTE: I.....0
READY.
```



# Designing Sprites



# Third Generation Consoles



Nintendo Entertainment System (NES)

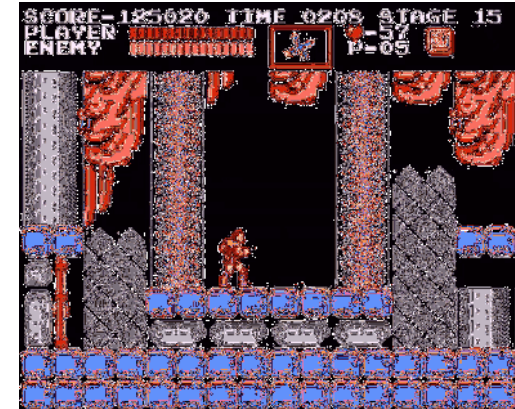
61.91 Million Sold



Sega Master System

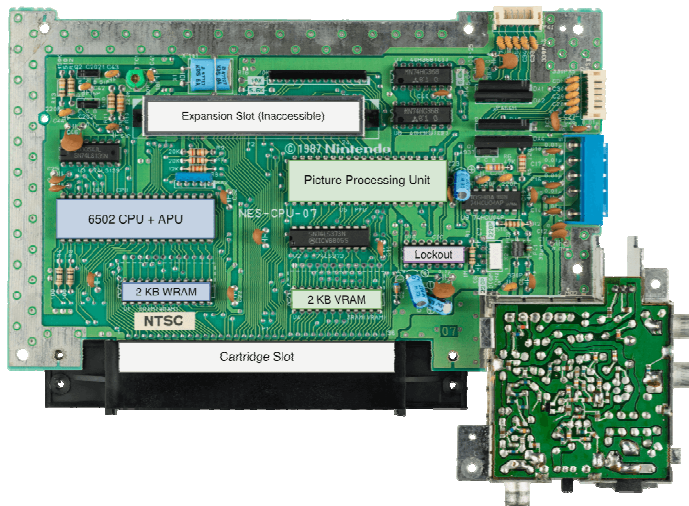
10-13 Million Sold

# Games



# Hardware

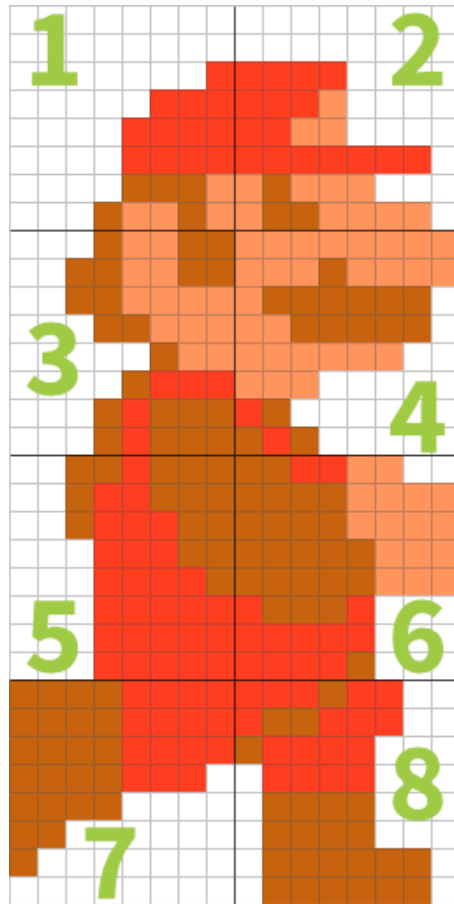
- MOS 6502 1.79 Mhz CPU (Ricoh 2A03 )
- 4KB RAM
- PPU( Picture Processing Unit)
- APU (Audio Processing Unit)



# Top Selling Games

	Game	Developer(s) <sup>[a]</sup>	Publisher(s) <sup>[a]</sup>	Release date <sup>[b]</sup>	Sales	Ref
1	<i>Super Mario Bros.</i> †	Nintendo R&D4	Nintendo	September 13, 1985	40,240,000	[1]
2	<i>Duck Hunt</i> †	Nintendo R&D1	Nintendo	April 21, 1984	28,310,000	[2]
3	<i>Super Mario Bros. 3</i> †	Nintendo R&D4	Nintendo	October 23, 1988	18,000,000	[3]
4	<i>Tetris</i>	Nintendo R&D1	Nintendo	November 1989	8,000,000	[4]
5	<i>Super Mario Bros. 2</i> (international version)	Nintendo R&D4	Nintendo	October 9, 1988	7,460,000	[3]
6	<i>The Legend of Zelda</i>	Nintendo R&D4	Nintendo	February 21, 1986	6,510,000	[5]
7	<i>Dr. Mario</i>	Nintendo R&D1	Nintendo	July 27, 1990	4,850,000	[6]
8	<i>Zelda II: The Adventure of Link</i>	Nintendo R&D4	Nintendo	January 14, 1987	4,380,000	[5]
9	<i>Excitebike</i>	Nintendo R&D1	Nintendo	November 30, 1984	4,160,000	[2]
10	<i>Golf</i>	Nintendo R&D1	Nintendo	May 1, 1984	4,010,000	[2]
11	<i>Teenage Mutant Ninja Turtles</i> †	Konami	JP: Konami NA: Ultra Games	May 12, 1989	4,000,000	[7]
12	<i>Dragon Quest III</i>	Chunsoft	Enix	February 10, 1988	3,895,000	[8]
13	<i>Kung Fu</i>	Nintendo R&D1	Nintendo	October 18, 1985	3,500,000	[2]
14	<i>Baseball</i>	Nintendo R&D1	Nintendo	December 7, 1983	3,200,000	[9]
15	<i>Dragon Quest IV</i>	Chunsoft	Enix	February 11, 1990	3,180,000	[8]
16	<i>World Class Track Meet</i> †	TRY Co.	Nintendo	December 23, 1986	3,080,000	[2]
17	<i>Punch-Out!!</i>	Nintendo R&D3	Nintendo	September 18, 1987	3,000,000	[10]
18	<i>Metroid</i>	Nintendo R&D1 <sup>[c]</sup>	Nintendo	August 6, 1986	2,730,000	[2]
19	<i>Super Mario Bros. 2</i> (Japanese version)	Nintendo R&D4	Nintendo	June 3, 1986	2,650,000	[2]

# Nes Sprites





# Controllers





# Development Tools



**Devkits**  
Development kits, known in the industry as devkits, are modified consoles used in the creation of games. Developers need specialized hardware in order to copy code and game assets from their computer to the console and see it running.

**Famicom development kit 1990**  
The Famicom, short for Family Computer, was Nintendo's original Japanese version of the NES. Working with the devkit involved copying code onto chips that were then inserted into the kit.

# Development Tools

- 6502 Assembly Language

The screenshot displays a development IDE with three main panels. The top-left panel, titled 'Outline', shows a project structure with sections like 'Definition Section', '\$2000 Start of code', 'start Run address', 'loop Load VCOUNT', and '\$2e0 Set run address'. The top-right panel, titled 'SmallExample.asm', shows the following assembly code:

```
WUDSN IDE example ATASM source file
; Supports hyperlink navigation includes.
.include "..\Macros.inc"

*
= $2000 ;Start of code
.opt ILL ;Enable use of illegal opcodes

start sei ;Run address
loop lda $d40b ;Load VCOUNT
      anc #12 ;Illegal opcode
      sta $d40a ;Change background color
      jmp loop1
*
= $2e0 ;Set run address
.word start
```

The bottom panel, titled 'Problems', shows a table of error messages:

Description	Resource	Location
2 errors, 1 warning, 1 other		
Errors (2 items)		
No binary file created.	SmallExample.asm	Unknown
Unknown symbol 'LOOP1'	SmallExample.asm	line 13
Warnings (1 item)		
.OPT ILL encountered (code would not compile on MAC/65)	SmallExample.asm	line 6
Infos (1 item)		
Symbols file 'C:\temp\atari.lib' created with 2 symbols.	SmallExample.asm	Unknown

# Forth Generation 16-Bit



Sega Mega Drive  
1988

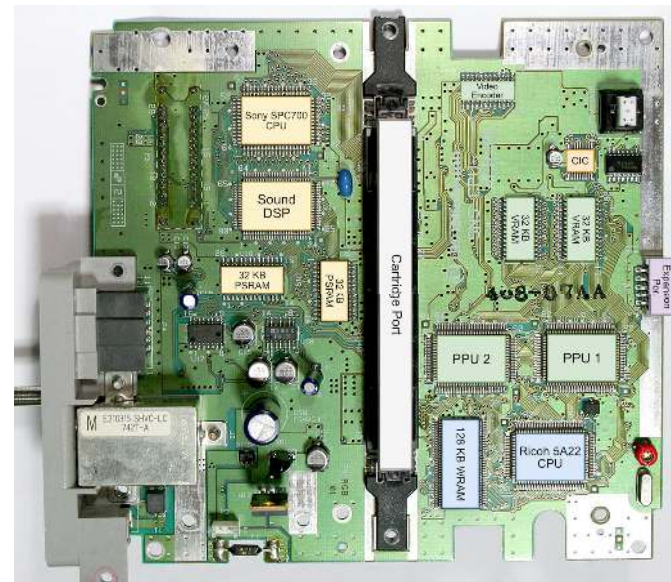


Super Nintendo  
1991

# Hardware



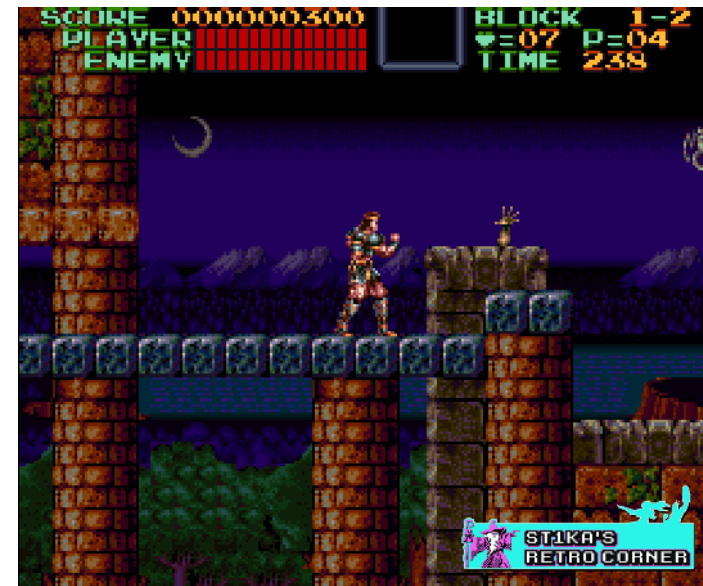
Sega Mega Drive



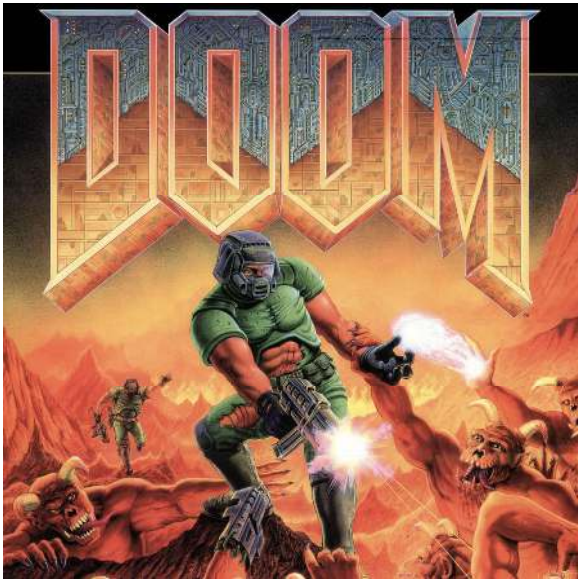
Super Nintendo



# SNES GAMES



# PC Enters The scene - 3D Games



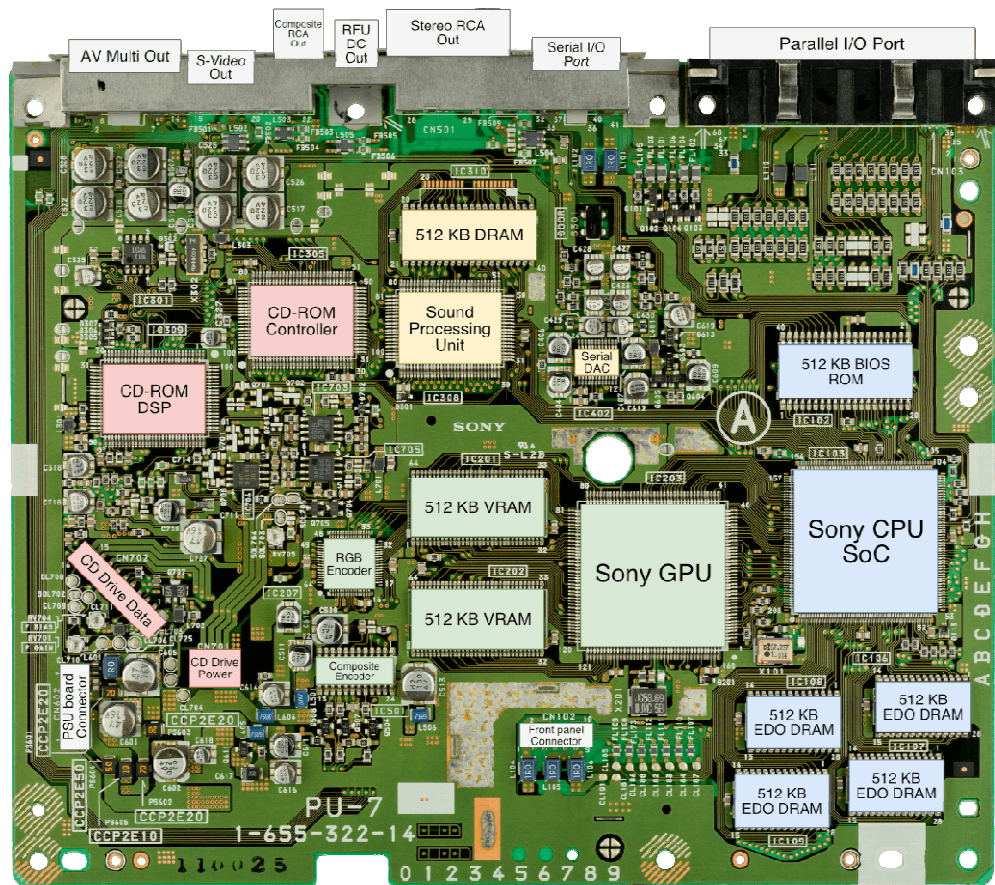
# Fifth Generation – 3D World

- Playstation
- Released in 1994
- 120 million units sold
- Games plays on CDs (Compact Discs)



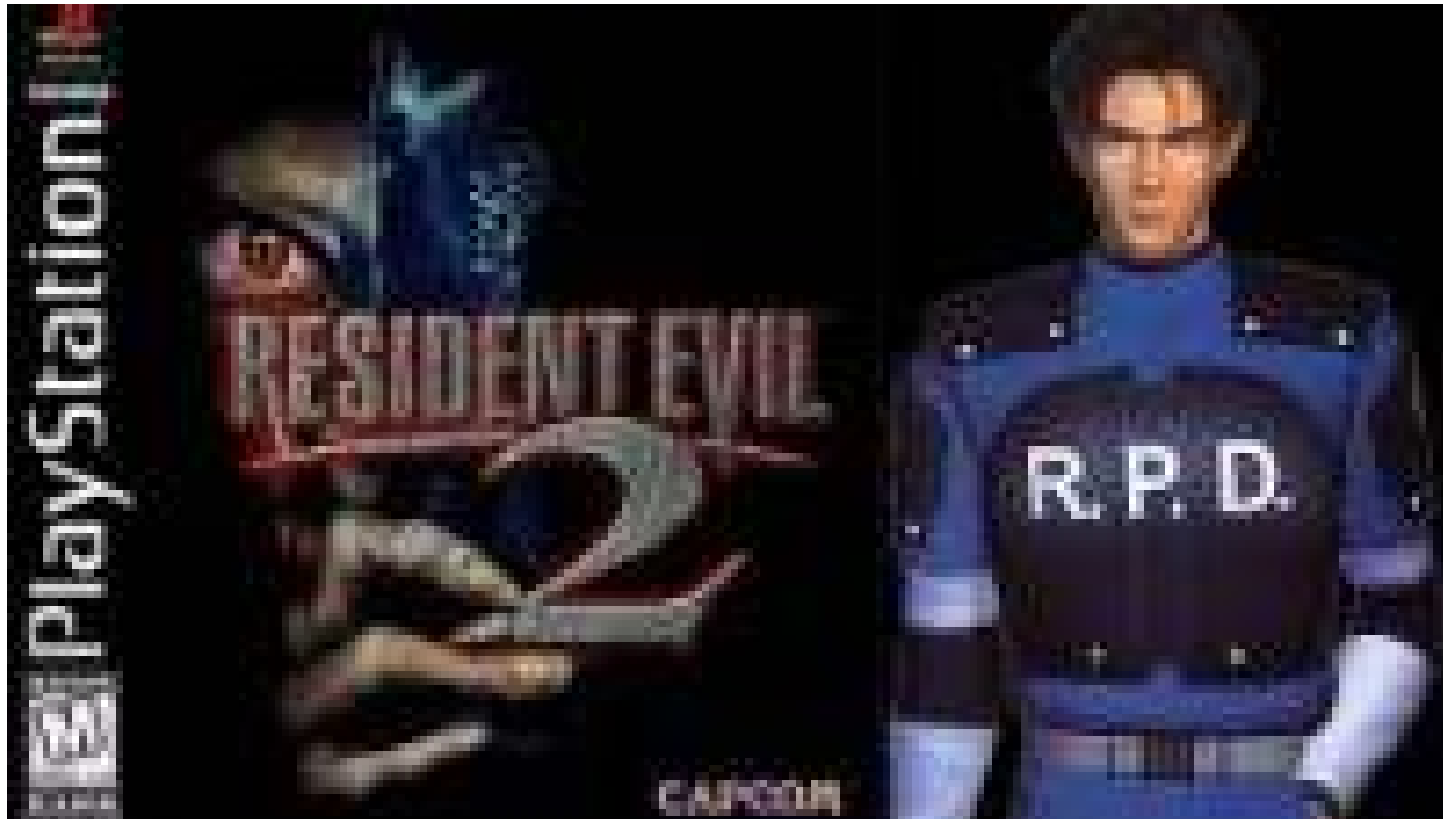


# 3D Power House





# Games



# Sixth Generation



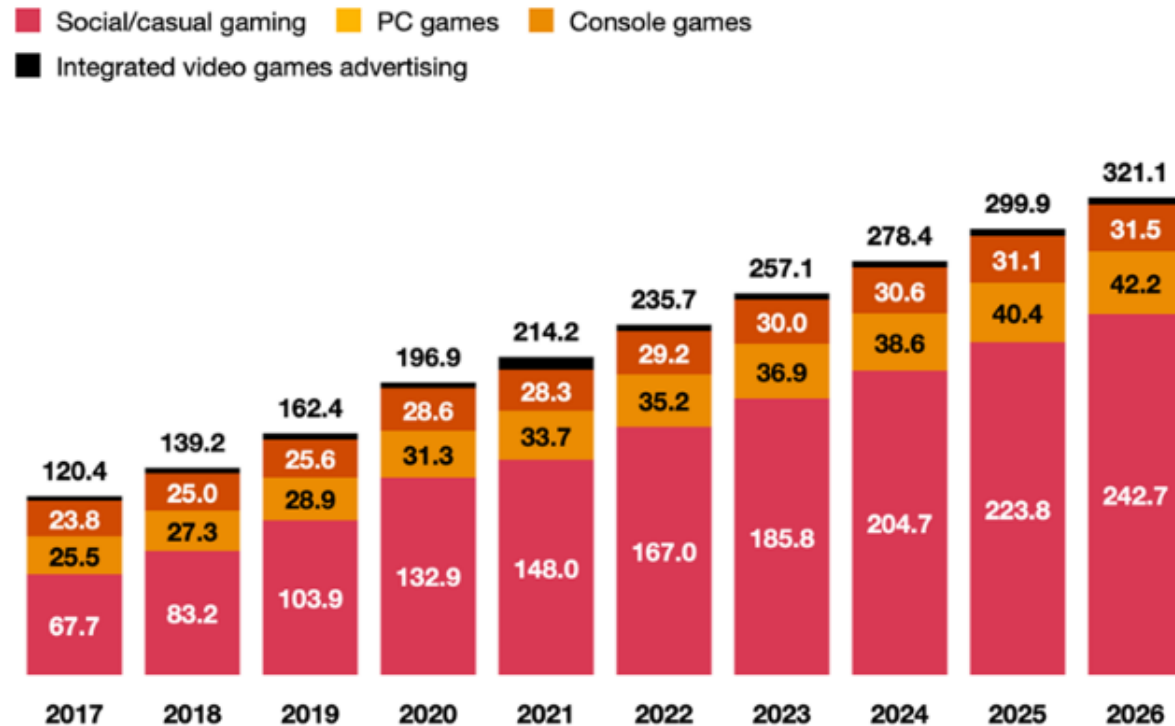
PlayStation 2 (2000)



XBOX (2001)

# Video Game Industry Keeps Growing

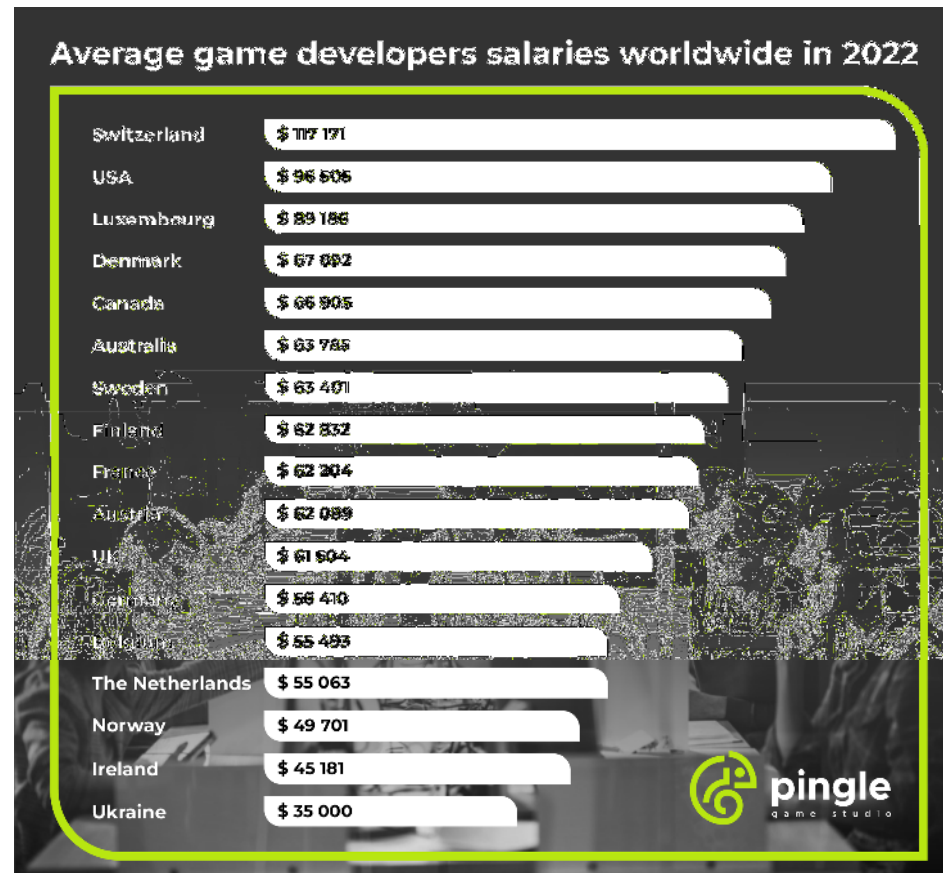
Total global video games revenue, by segment (US\$bn)



Note: 2021 is the latest available data. 2022–2026 values are forecasts.

Source: PwC's Global Entertainment & Media Outlook 2022–2026, Omdia

# Game Developers Salaries



# Types of Jobs

- Game Designer
- **Game Programmer**
- **AI Programmer**
- System Designer
- Level Designer
- Game Artist (Character – environment- asset etc.)

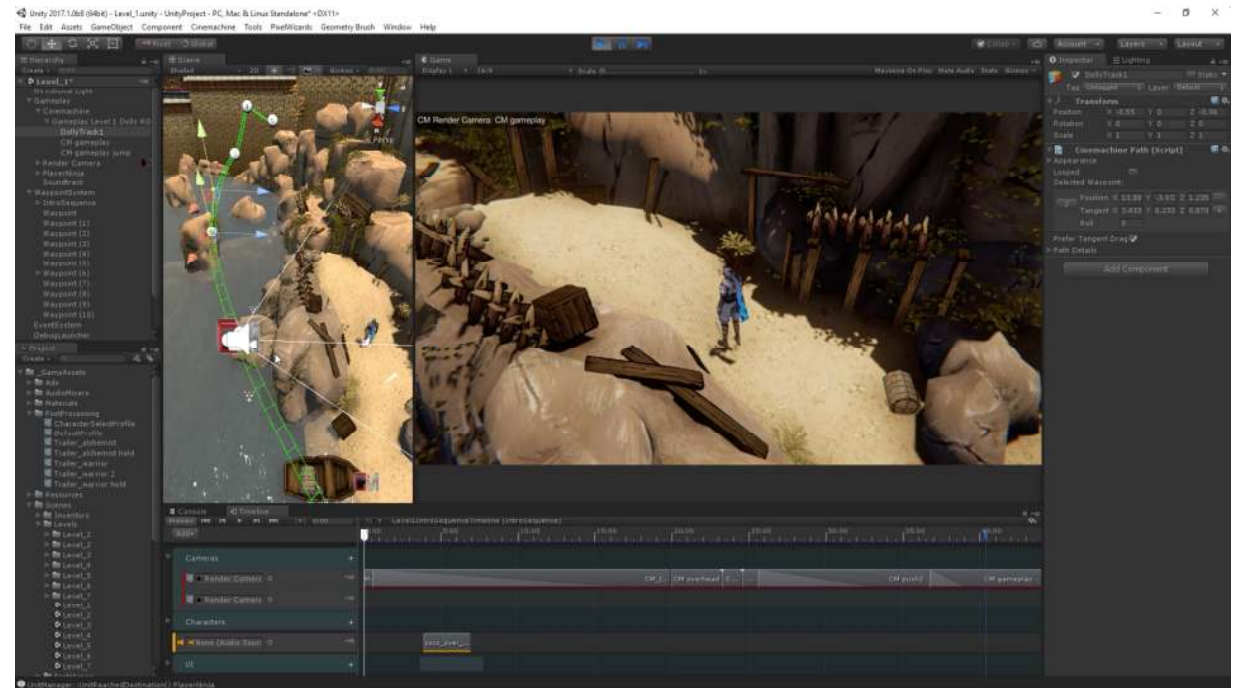
# Development Tools

- Game Engines



# Unity

- Free to use
- Easier to learn
- Support Multiple Platform



# Unreal

- Free to use
- Little bit harder to use
- Support Multiple Platform
- Can handle Much More Complex Games

