History of gaming consoles

- First home videogame console released in 1972
- Currently in the eighth generation of consoles
- Many manufacturers at times, now only a handful.
Magnavox Odyssey

- No microprocessor
- No memory
- All components for games inside console
- Cartridges connected internal components to each other
- Displayed to TV through RF inputs
Atari 2600

- Released September 11, 1977 by Atari Inc.
- Utilized a microprocessor-based architecture and ROM cartridges containing game code. First console to use external cartridges
- MOS Technology 6507 CPU
- 128 bytes of RAM on system.

A Look at The MOS 6507

- Stripped-down 6502
- 8kB of external memory space
- Used 13 memory access pins
- Ran at 1.19MHz
NES

- MOS 6502 at 1.79MHz
  - No multiply or divide
  - No floating point operations
- 2KB of RAM from $0000 to $0800
- PPU (Picture Processing Unit)
  - Render background and up to 64 sprites
- APU (Audio Processing Unit)
- Advanced cartridges overcame hardware limitations
Super NES

- 16-bit design. Incorporated graphics and sound co-processors over an expensive CPU
- Allowed dramatic extension of computing power by using chip upgrades inside game cartridges
- 65C816 CPU at 3.58 MHz and 128 kB of RAM
- 256 Colors on screen and 128 maximum sprites
- Separate co-processors include:
  - Picture Processing Unit
  - Audio Processing Unit
  - Pulse Code Modulator
**PlayStation**

- First system to ship 100 million units.
- Focus on 3D Polygon graphics over 2D Sprite graphics
- First successful system that used optical disks
- MIPS R3000A 33.8688MHz processor
- 2MB main RAM, 1MB VRAM
- Used memory cards to save games and system data
- Could also play music CDs

**A Look at The R3000A**

- 32 bit word size
- 4kB instruction cache and 1kB data cache
- 30 MIPS performance
Gamecube

- IBM PowerPC 750CXe
  - Cheap
  - Low heat output
- Flipper GPU
  - Also housed Macronix DSP to replace APU
- No built-in hard drive, ethernet or modem
- Introduced the miniDVD format
  - Improved loading times from 12 to 3 seconds
  - Made piracy near impossible
  - Improved durability
- Represents 5th console generation
- Sony wins the ‘Console War’, selling 155 million units to Nintendo’s 21.74 million and Xbox’s 24 million.
- Reasons for Sony’s success are attributed to:
  - PS2 could play DVDs and CDs, so also doubled as a DVD player.
  - PS2 had backwards compatibility, and better 3rd party game developer support

### Playstation 2 vs Nintendo Gamecube

<table>
<thead>
<tr>
<th>PS2 - $299</th>
<th>Gamecube - $199</th>
</tr>
</thead>
<tbody>
<tr>
<td>128 Bit “Emotion Engine” running at 300MHz</td>
<td>MPU: IBM Power PC “Gekko” at 485MHz</td>
</tr>
<tr>
<td>32 MB direct rambus</td>
<td>24MB main memory</td>
</tr>
<tr>
<td>3.2GB/s bus bandwidth</td>
<td>2.6 GB/s bus bandwidth</td>
</tr>
<tr>
<td>FPU co processor and two vector units</td>
<td></td>
</tr>
<tr>
<td>FP Performance: 6.2 GFLOPS</td>
<td>FP Performance: 10.5 GFLOPS</td>
</tr>
<tr>
<td>Graphics “Synthesizer”: 150MHz clock frequency; 3 million to 16 million polygons per second</td>
<td>Real World performance: 6 to 12 million polygons per second</td>
</tr>
</tbody>
</table>
More on PS2 vs. GameCube

- Both systems used memory cards for game data and some system data
- Gamecube used miniDVD format, but could not natively play standard DVDs or CDs
- Gamecube was capable of stereoscopic 3D, however was never enabled outside of development
- Over 10,000 titles for the PS2, over 600 for Gamecube
With generation 7, three main competitors emerged: Microsoft (XBOX 360), Sony (PS3), and Nintendo (Wii).

All systems represented a very large jump in power from the previous generations, but more importantly, multimedia support became more widespread.

The 360 and PS3 both supported ‘Apps’ like Netflix, HBOGo, Youtube, etc.

PS3 played Blu-rays, becoming one of the cheapest Blu-ray players on the market.

XBOX360 used HD-DVD, which quickly fell to blu-ray.

The focus became less upon games, more upon being an ‘Entertainment System’

<table>
<thead>
<tr>
<th>PS3 Specs</th>
<th>Xbox 360 Specs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cell microprocessor, 7 single-thread cores (1 backup) at 3.2GHz</td>
<td>3 Core 6 thread PowerPC CPU at 3.2GHz each</td>
</tr>
<tr>
<td>64 bit word size</td>
<td></td>
</tr>
<tr>
<td>230 GFLOP performance</td>
<td>77 GFLOP performance</td>
</tr>
<tr>
<td>76.8GB/s I/O bandwidth</td>
<td></td>
</tr>
<tr>
<td>25.6GB/s Memory Bandwidth</td>
<td>22.4 GB/s memory bandwidth</td>
</tr>
<tr>
<td>L1 cache (64KB, even split I/D) L2 cache 512 KB</td>
<td>1 MB L2 cache</td>
</tr>
<tr>
<td>256 MB main memory and separate 256MB VRAM</td>
<td>512 MB RAM, unified memory</td>
</tr>
<tr>
<td>2 TFLOPS FP performance</td>
<td>1 TFLOP FP performance</td>
</tr>
</tbody>
</table>
Current Generation: Gen 8

- Microsoft (XBOX One), Sony (PS4), and Nintendo (Wii U) still the ‘big three’
- Nintendo focuses on a more ‘traditional’ console instead of relying on motion-controller gimmick
- Microsoft places a large focus on the XBOX being an ‘Entertainment System’, focusing on more than just gaming
- Microsoft adopts Blu-ray
- Sony returns to gaming roots, large focus on game performance rather than overall performance

Major Shift: Current and future game systems are no longer just for gaming; focus has been placed on being a more ‘general purpose entertainment system’ with the advent of built in support for video and music services
Citations

PC: Undisputed Gaming Champion

1977 - Always