SNIA DEVELOPER CONFERENCE
SDC 25
By Developers FOR Developers

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# Media Objectives for Next-Generation Video Games

John Carlsen, Syncopated Systems
https://www.syncopate.us

# John Carlsen – Brief Intro

- Work in video games/computer multimedia
  - Atari, Nolan Bushnell, Activision, Iguana Entertainment, Acclaim, Sony PlayStation
  - Media Vision (PC audio, CD-ROM), SigmaTel (MP3 player SoC)
  - Taught game scripting (Assistant Professor @ ACC – 2009)
- Independent R&D contractor/consultant dba Syncopated Systems
  - Many other projects in games, transportation, machine control, etc.
  - Volunteer: IEEE, USAF-CAP, PaloAltoAirport.org (9/28), science-fair.org (3/9-10)
    - IEEE Consultants' Network of Silicon Valley director, 2023-2024 chair, 2022 vice chair
    - IEEE Silicon Valley Technology History Committee
  - Before COVID, presented every ~2 years – last @ SDC 2019

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# Why Storage for Video Games?

- Games are fun and bring people together
- Games are big business
  - Industry trends up and down, overall upward
  - Many early companies, now consolidated to 3 that make/control consoles
  - Hungry for new technologies
- Big-budget games need big distribution media
  - Current media approaches practical limits
  - “We’re gonna need a bigger boat.”

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# Name of the Game (Industry)

- Video games, TV games
  - Coin-Operated (in arcades, local shops)
  - TV games (built-in single game or few games)
  - Consoles with replaceable media
- Computer games, computer entertainment
  - e.g. Sony Computer Entertainment (SCE, PlayStation division 1993-2016)
- Interactive multimedia, interactive entertainment
  - e.g. Sony Interactive Entertainment (SIE, PlayStation division 2016-present)

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# Video Games – Then and Now

- 1972: video games commercialized
  - Aug: Bar-top Atari Pong at Andy Capp's Tavern (now Rooster T. Feathers)
    - 1971 Computer Space flopped
  - Sept: Magnavox Odyssey TV game
- 1976: Fairchild VES introduces replaceable software cartridges
  - License from Alpex, influenced Atari VCS (1977)
- 1983-1985: video game crash
  - Caused by oversupply of game cartridges, many low-quality
  - Drove industry to protectionism (e.g. Nintendo Seal of Quality, lockout mechanisms)

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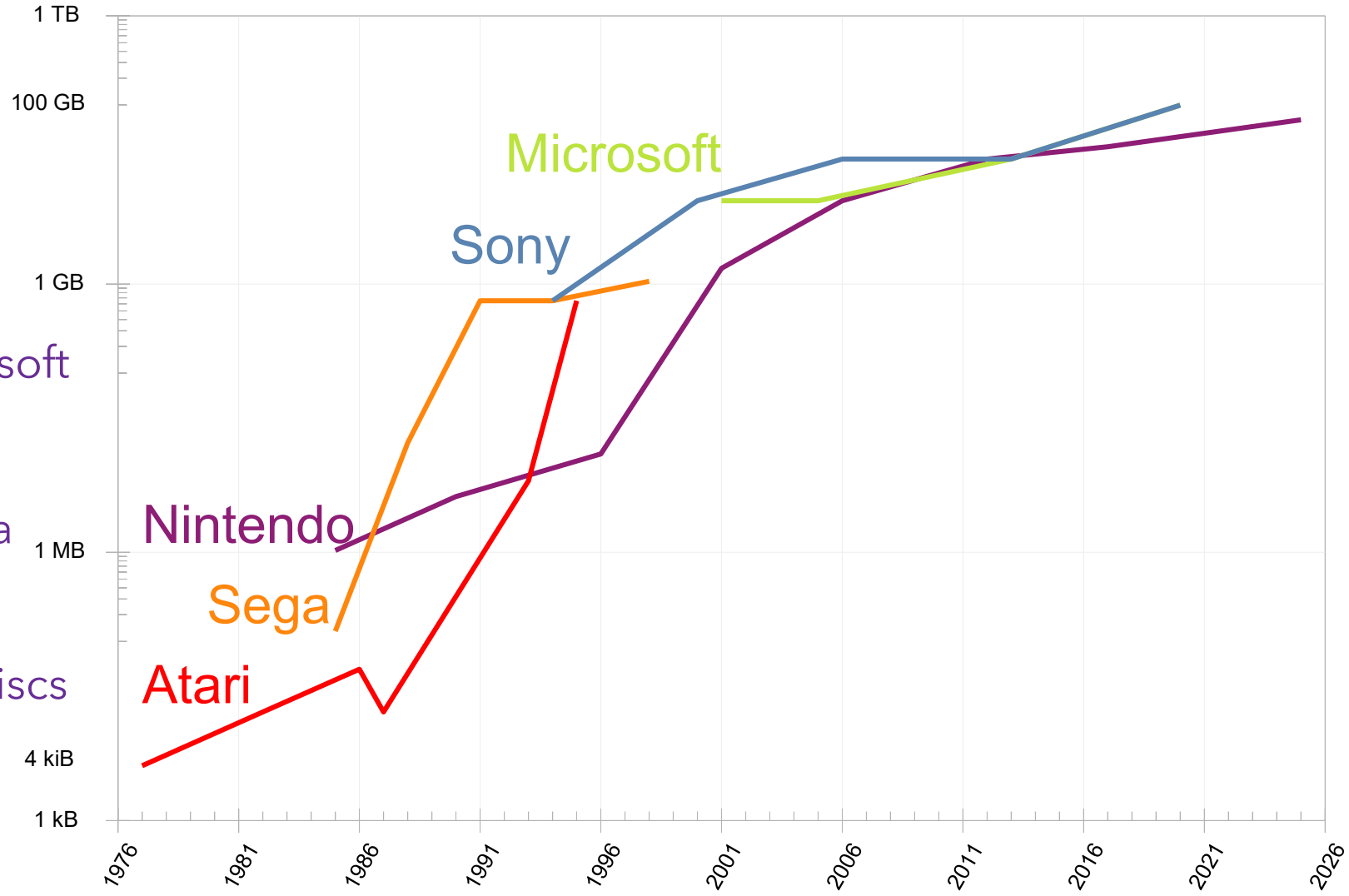
# Game Console Media Sizes and Types by Year (1)

- Major Players
  - Many in early years
  - Fairchild, Atari, Sega
  - Nintendo, Sony, Microsoft
- Industry Events
  - 1976 removable media
  - 1983 crash, quality++
  - 1991-'97 first optical discs
  - Nov start of 49th year

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# Microsoft

- Started in 1975 by with homage to DEC BASIC on Altair 8800
- World's largest software maker (by revenue, 2022)[1]
- 1990: Entered computer games w Microsoft Entertainment Packs
- 2001: Released Xbox game console
- 2023: Acquired Activision Blizzard ($68.7bn)[1]
- 8.3% ($23.45bn) of FY2025 revenue was from Xbox[2,3]

[1] https://en.wikipedia.org/wiki/Microsoft
[2] https://www.tweaktown.com/news/106738/xbox-delivers-record-23-45-billion-annual-revenue-hardware-drops-25/index.html
[3] https://thisweekinvideogames.com/news/microsoft-fy2025-financial-report-xbox-revenue/

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# Sony

- Started in 1955 with portable transistor radio (TR-55)
- World's 5th largest media conglomerate
- Former Nintendo partner, entered games in 1994 with PlayStation
- 36% of FY2024 revenue was from PlayStation ($31.7bn)[4]
  - 54% Game and content sales ($17bn)
  - 24% Console sales ($7.7bn)
  - 14% Gaming services ($4.5bn)

[4] https://app2top.com/news/sonys-annual-report-increase-in-gaming-division-revenue-and-decline-in-console-sales-280566.html

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# Nintendo

- Started in 1889 making playing cards[5]
- It's a games company
- FY2025 revenue was $7.818bn[6]

[5] https://en.wikipedia.org/wiki/Nintendo
[6] https://www.nintendo.co.jp/ir/pdf/2025/annual2503e.pdf

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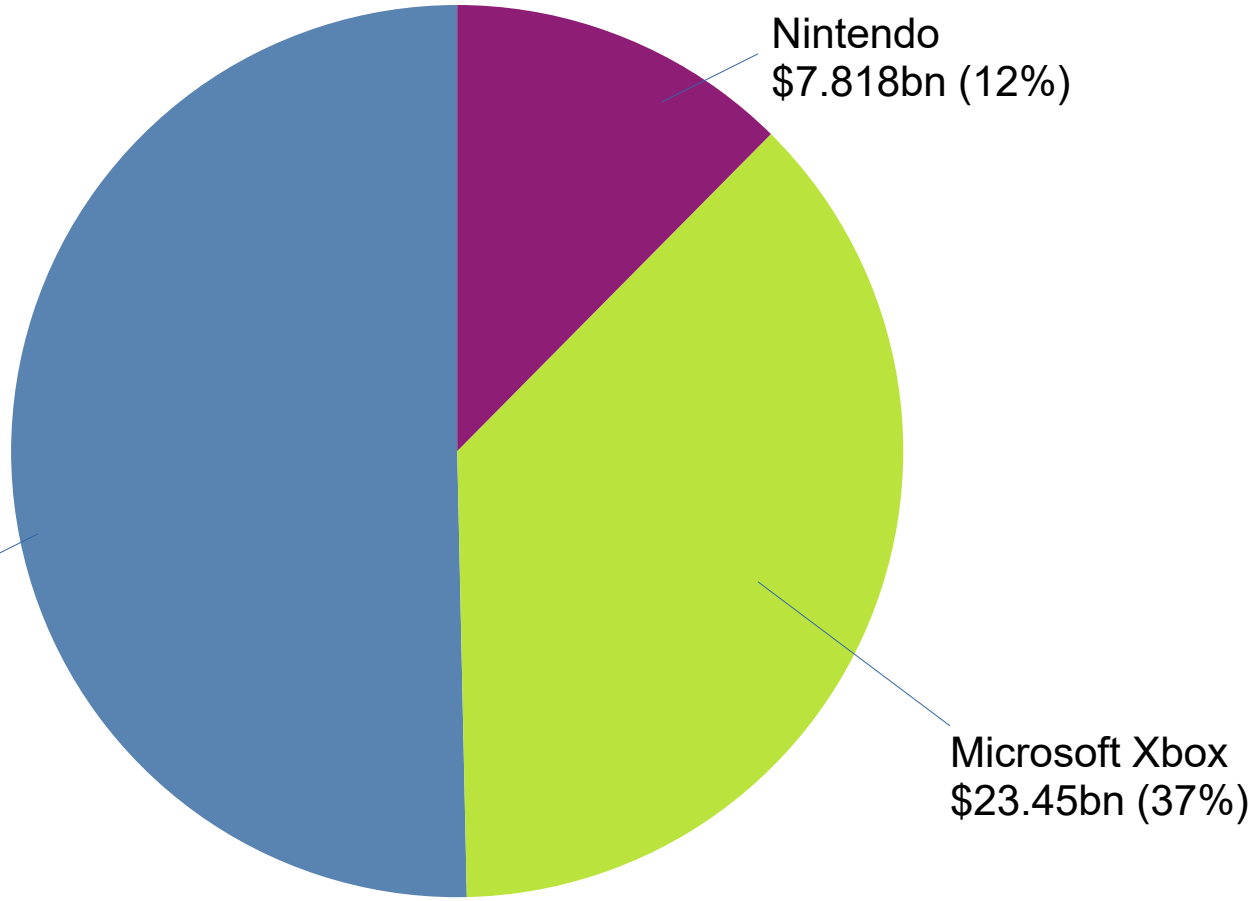
# Market Share Today – Console Makers




by Annual Revenues

Total: $62.968bn

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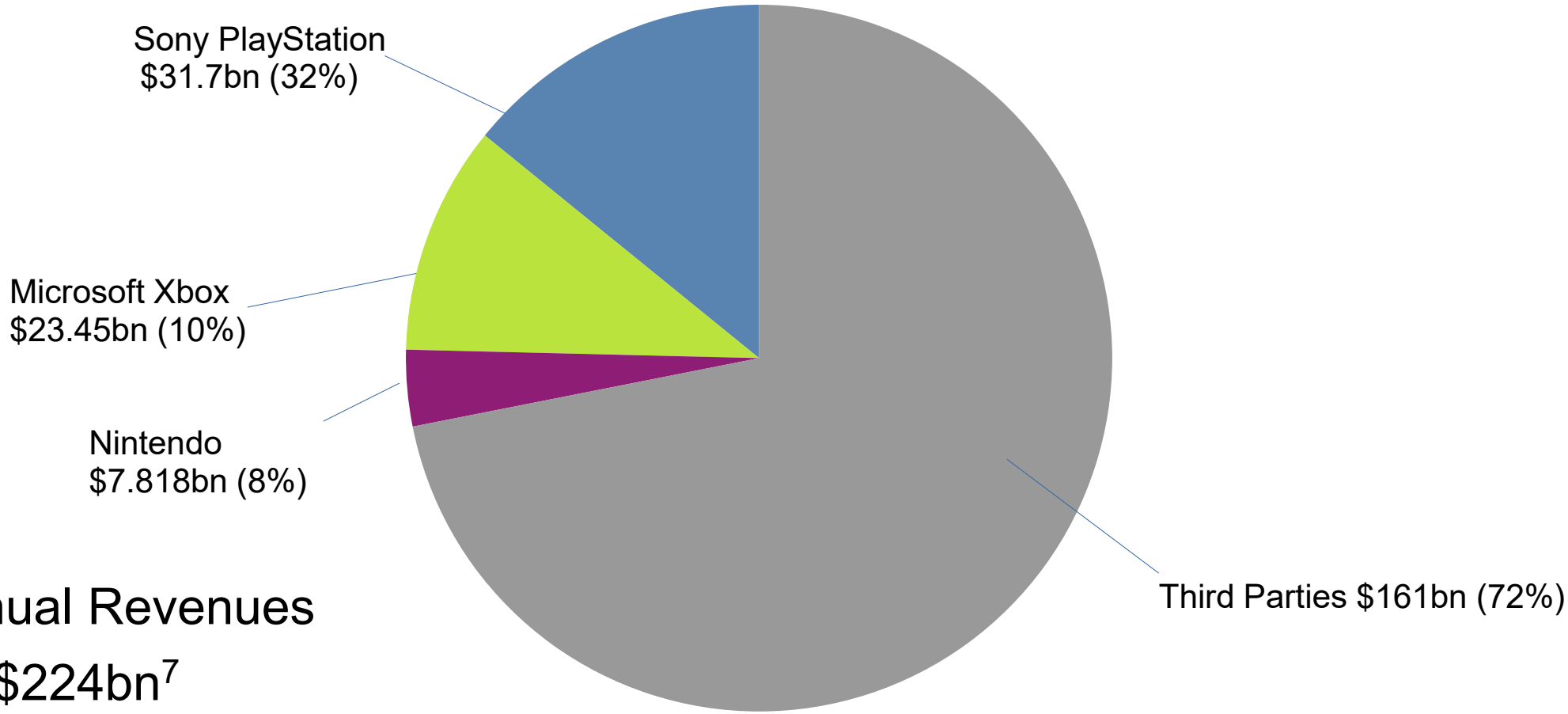
# Market Share Today – Global Total 2024




by Annual Revenues

Total: $224bn[7]

[7] https://www.pwc.com/gx/en/news-room/press-releases/2025/pwc-global-entertainment-media-outlook.html

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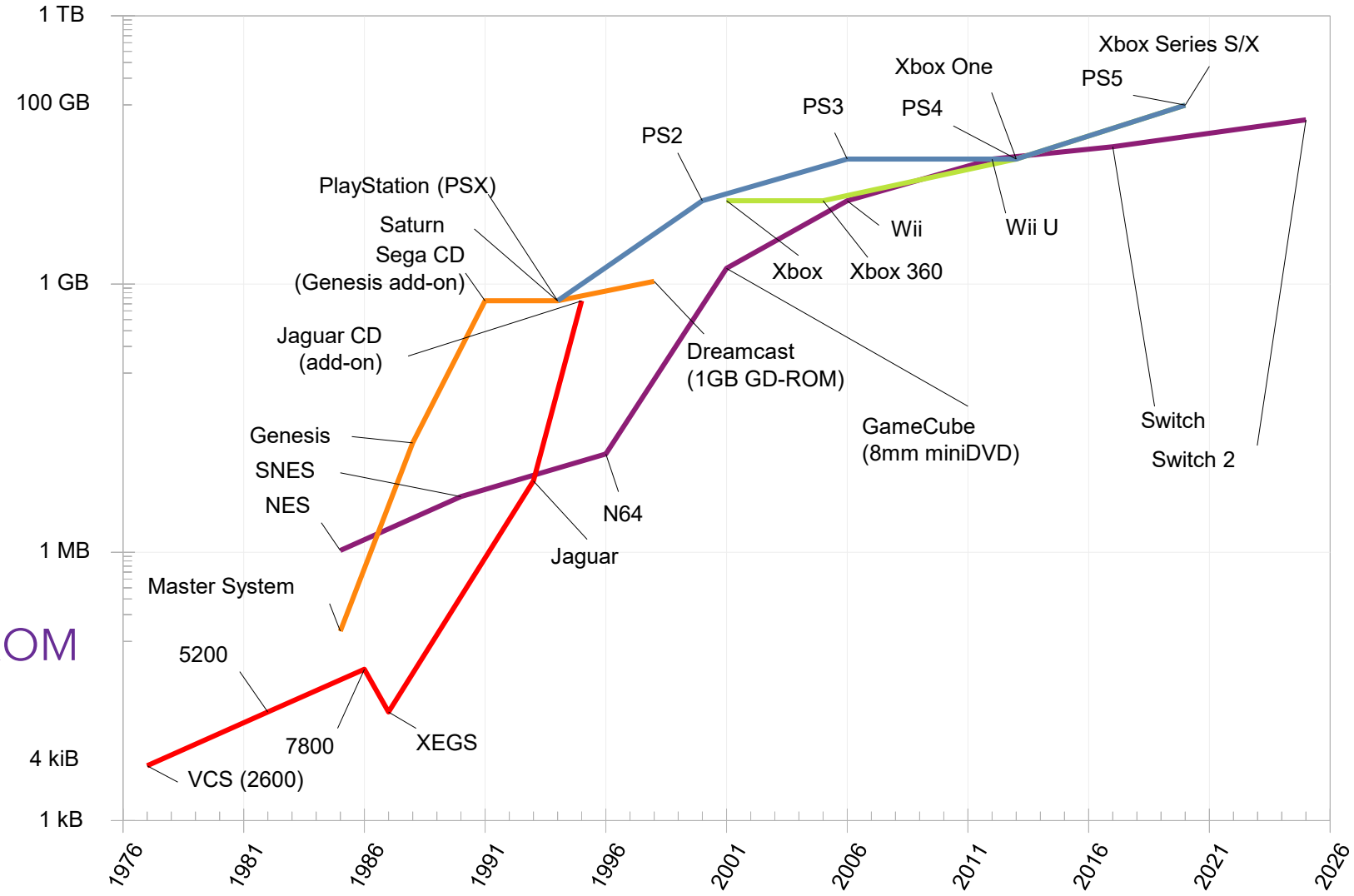
# Game Console Media Sizes and Types by Year (2)

- Generations
  - ~5-6 years each
- Partnerships
  - Nintendo-Sony: SNES (SNES CD-ROM?)
  - Nintendo-SGI: N64 (stacked-die ROMs?)
  - Sega-Panasonic: GD-ROM
  - Sony-MIPS (SGI): PSX

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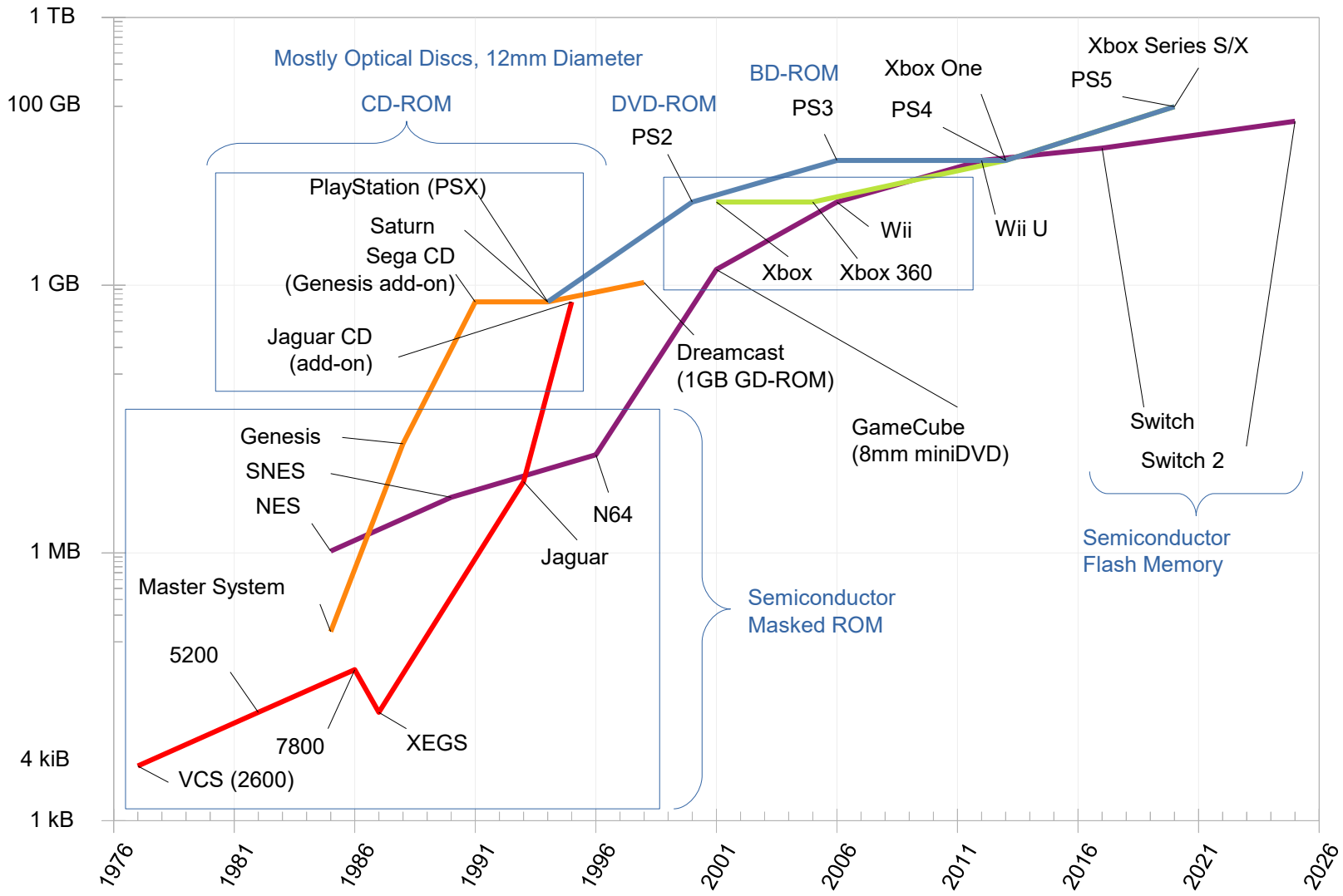
# Game Console Media Sizes and Types by Year (3)

- Si Masked ROMs
  - 1976-2001
- Optical Discs
  - 1991/1994-Present
  - Mostly 12mm
  - CD, DVD, Blu-ray
- Si Flash
  - 2017-Present

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# Observations

- ROM cartridges lasted 25 years
  - Half the history of replaceable game media
- 12 mm optical discs dominated the last 31 years
  - 1st gen disc (CD-ROM) lasted 5 years
  - 2nd gen disc (DVD-ROM) lasted 6 years
  - 3rd gen disc (Blu-ray) is 19 years old
    - Pushing limits of original 4-layer spec from 100 GB to 128 GB
    - Overdue for replacement
- Game media growth is leveling off due to tech limits

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# Game Industry Stakeholders and Interests

- Console makers – ROI, balance consoles vs. games
  - Maybe like razors and razor blades
- Publishers, Developers – cost/ease of development, ROI
- Distributors, retailers – store/online capacity (esp. @ release-time)
- Consumers, players – fun, ease of use, DLC hidden cost, peers
- Post-consumer: collectors, archivists – permanence, resale value

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# Physical Media vs. Downloads

- Downloadable content (DLC)
  - Short delivery time after purchase
  - Hidden costs borne by users (storage space on SSD, cable modem)
- Physical media – use cases
  - “Pack-in” game(s) – sold with console
  - Large (big budget) games
  - Reach users with no/limited internet connection or local storage

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# Game Media – Ideal Attributes

- Low cost – of both media and authoring tools
- High capacity for data distribution
  - Storage vs processing trade-offs (e.g. algorithmic synthesization, stored renders)
- Fast access, transfer
- Some capacity to save user data
  - R/W to save games, treasures, license keys, etc.
  - Historically ~1% size of game payload
- Long data retention
  - Use/resale beyond current console's generation, archival (historians)

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# Personal Data Points: Authoring Tools for SNES

- SNES 1990: $60k
  - Nintendo

*BIG METAL BOX*

- SNES 1991: $15k
  - Nintendo


- SNES 1993: ~$500
  - Iguana Entertainment


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# Personal Data Points: More Authoring Tools

- 1991 PC CD-ROM
  - $25k Median Data
  - SCSI JBOD
  - Used to master Microsoft Windows

*BIG METAL BOX*

- 1995 Nintendo 64
  - $100k-250k SGI Onyx
  - 120VAC @ 20A


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# Modern Nintendo Game Cards Come Close

- Versions for Switch (1-32 GB), Switch 2 (64 GB)
- Pros:
  - Probably much faster than BD (assuming signaling similar to PCIe, maybe 8× to >200×)
- Cons:
  - Cost higher than BD
  - Capacity only half of BD
  - Too small, tastes terrible



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# What Would I Like to See?

- Store bulk of data in masked ROM
  - Pros: high density, low cost, low power, permanent by construction
  - Cons: long mfg lead time, can't correct mistakes
- Smaller area with smart flash (controller enabled)
  - Should be non-critical; game should play if flash fails/corrupts
  - Include "patch table" function for last-minute fixes
  - User data area (save games, treasures, license keys, etc.)
- Physically too big to swallow
  - Suitable for all ages, safe around younger siblings/housemates

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# Who Might Make It?

- Masked ROM
  - Process nodes may be mature, not cutting edge
  - Interconnect: die stacking likely inferior to planar (like chiplets)
- Flash
  - In multi-chip module, easier to use diferent process than masked ROM
- System interface
  - Similar to Nintendo Switch 2 and/or PCIe
- Someone in SNIA, SDC, this room?

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# Questions?

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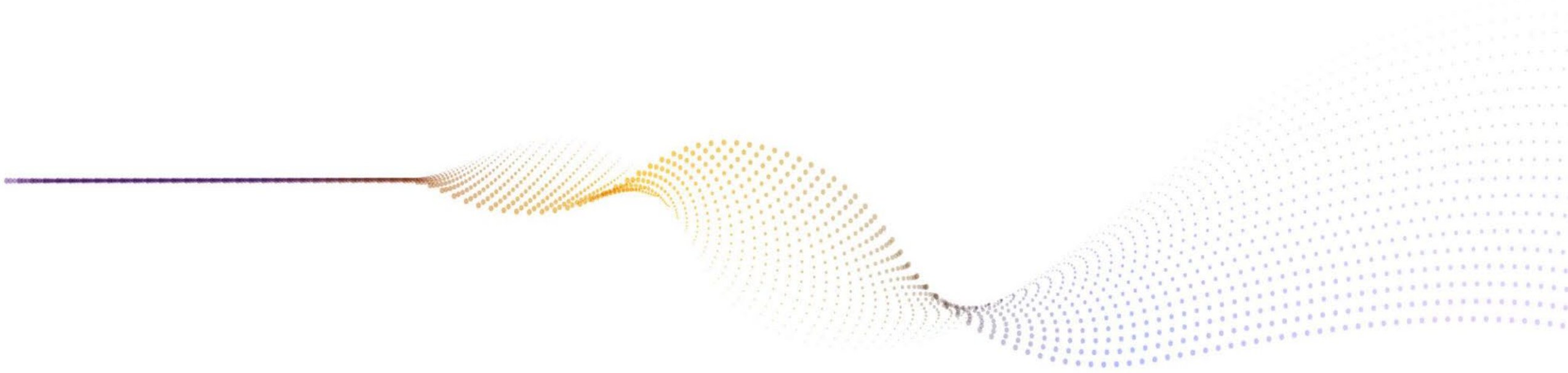

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