



Flash Memory Summit

Emerging Opportunities for Non-Volatile Memories in Video Games

John Carlsen

Syncopated Systems – Sunnyvale, CA



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Agenda

- Brief intro: my career in games
- Why should we talk about video games?
- What trends reveal opportunities?
- What does this industry want and need?
- Summary
- Q & A



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John Carlsen – Career Highlights

- Atari + founder Nolan Bushnell
- Activision/Infocom (Mediagenic)
- Media Vision, Iguana/Acclaim Entertainment
- Altera, SigmaTel (flash-based MP3 players)
- Taught game development
- Sony PlayStation, Retro VGS

IEEE Senior Member, IGDA, SMTA



Why talk about video games?

- Promote understanding, common terminology
- Opportunities to sell more memory devices
- Playing games is fun!
(But making games is real work...)



What are we really talking about?

- “Interactive entertainment”
 - Differentiate passive/non-interactive (music, film, TV)
 - Can be more than just games, including virtual reality (VR), augmented reality (AR)
- Parties: Developer, Publisher, Retailer, Player
- Venues: Arcades, Home, Mobile



How are Memories Used in Interactive Entertainment?

- Program distribution
 - From ROM cart./disc to network-to-HDD/SSD
- User data (scores, saved games, playback)
 - ROM cartridges had added SRAM + coin cell
 - With discs, memory cards were used
 - Now stored on system (HDD/SSD/equiv.)
- Development systems
 - ROM/disc emulators



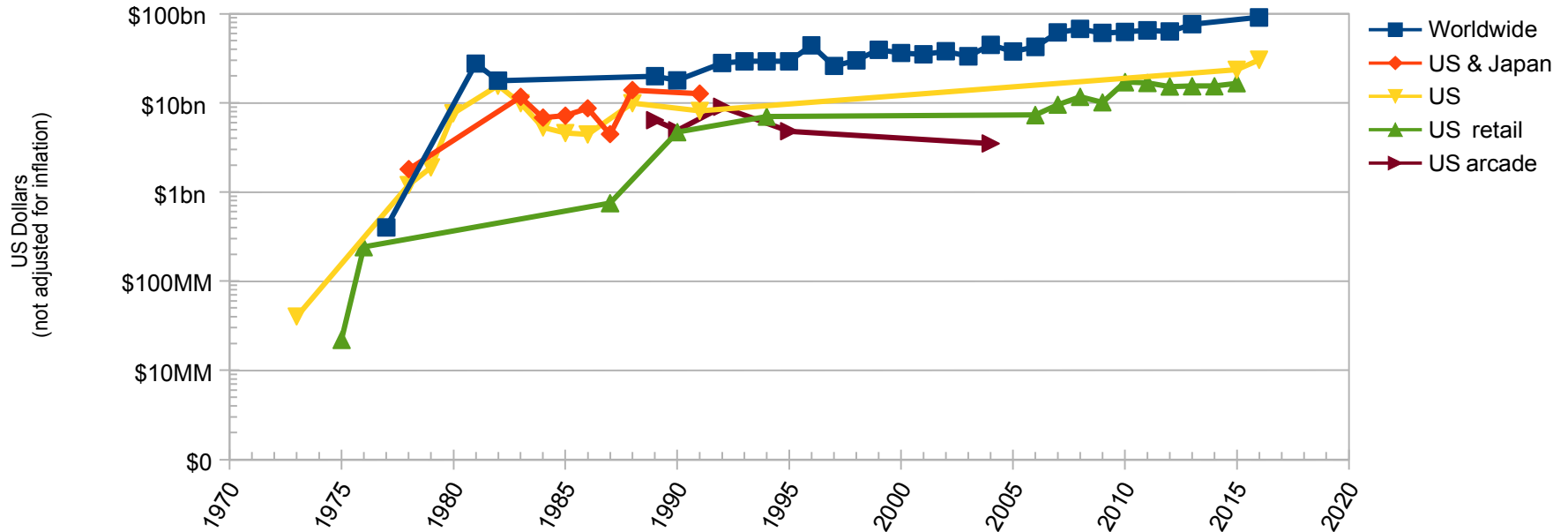
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Opportunities to Sell More Memory

- Big market, with continued strong growth
- Game developers and players are hungry for memory
- And something else...



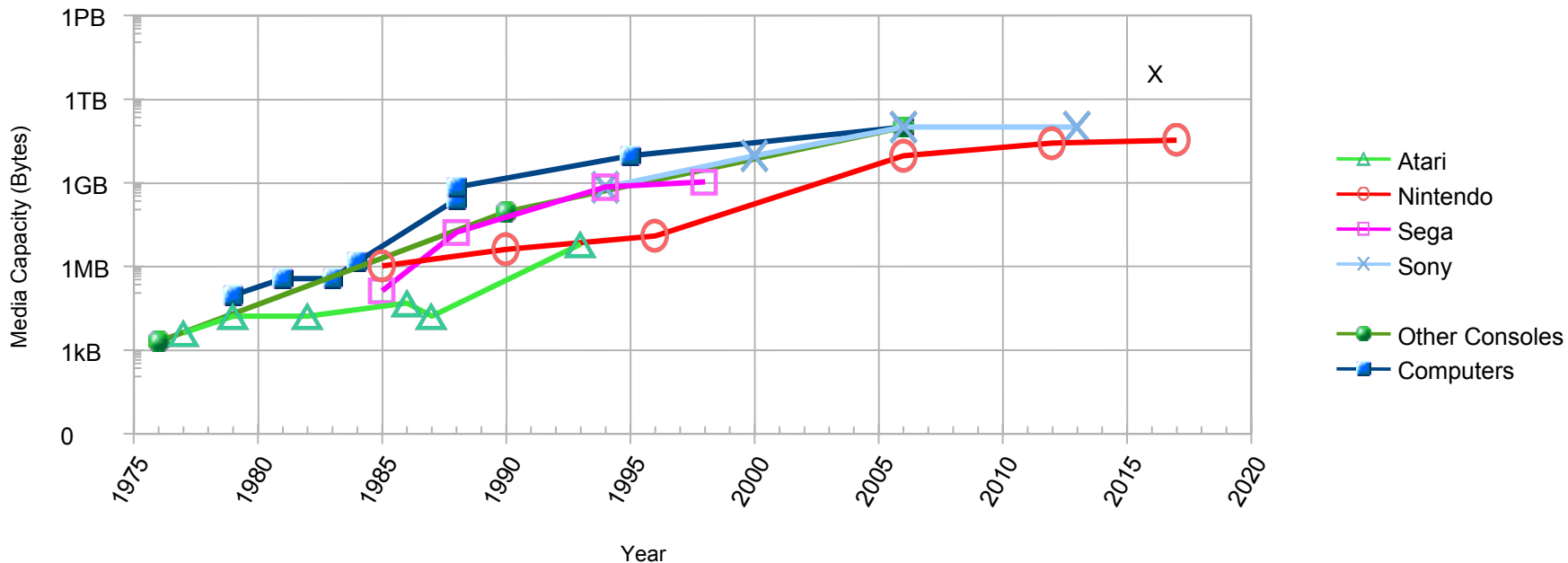
Interactive Entertainment: Big Market, Continued Growth





Interactive Entertainment: Hungry for Memory

Maximum Capacity of Physical Distribution Media





Interactive Entertainment Industry: What it Wants and Needs

- Developers Want:
 - To make a great (big) game, using the most capacity (cost) the publisher will allow
 - Low-cost development tools
 - Tools that enable quick iterations
 - Fast retrieval and high throughput (performance last)



Interactive Entertainment Industry: What it Wants and Needs

- Publishers Want:
 - As little cost (capacity) as the developer can use
 - Minimal time-to-market
(quick iterations, getting most of the bugs out)
 - Fast retrieval and high throughput
(performance last)



Interactive Entertainment Industry: What it Wants and Needs

- End Users (Players) Want:
 - To play a great (big) game (capacity)
 - Data retention (save game data, to play later)
 - Fast installation and load times (performance)
 - To avoid forced updates (due to bugs, etc.)
 - Most want high value (# hours play vs. cost)
 - Some want speed of online purchase & download
 - Some want program retention, ability to resell



Summary

- Player priorities vary
- Developers & publishers:
 - Can negotiate game sizes
 - Prioritize cost over performance
 - Should again test games better before release
- Growth in game media sizes stalled
 - Correction due?
- Brazil is catching up, good market for memory



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1. [thanks to FMS for allowing me to talk about something different]
2. [show of hands: within the last year, who has watched a feature-length film? vs played a video game?]



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1987 Atari

1988-1989 Nolan Bushnell

1990-1991 Mediagenic (parent to Activision Infocom brands)

1991-1996 Media Vision, Iguana Entertainment

1996-1999 Altera

2000-2001 SigmaTel (intro'd SoC, dominated flash-based MP3 players)

Created Syncopated Systems

2006 contract with Sony – disc access on PlayStation 3, PSP, PC

2009 teaching game development

2010-2011 developing a PlayStation to be made in Brazil

2013 game conference

2015 “Retro VGS” - what was to be a cartridge-based system launched via crowd-funding

fairly active in IEEE, IGDA, SMTA



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(But making games is real work...)

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Playing games is fun!

1. can also sharpen the mind, coordination, social interaction, physical activity
2. (Making games is real work...)



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Saving and resuming game play started by giving users codes to transcribe

Newer systems such as Nintendo Switch may use an SD card like internal storage (SSD)

History of sample tools costs:

1990: \$60k for a development station for Super Nintendo

1991: \$15k for a development station for Super Nintendo

1991: \$25k for a system to master a CD-ROM

1991-1996: my Super Nintendo and PlayStation systems were much cheaper

2006: \$10k for a development station for PlayStation 3

2013: \$2.5k for a development station for PlayStation 4



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Opportunities to Sell More Memory

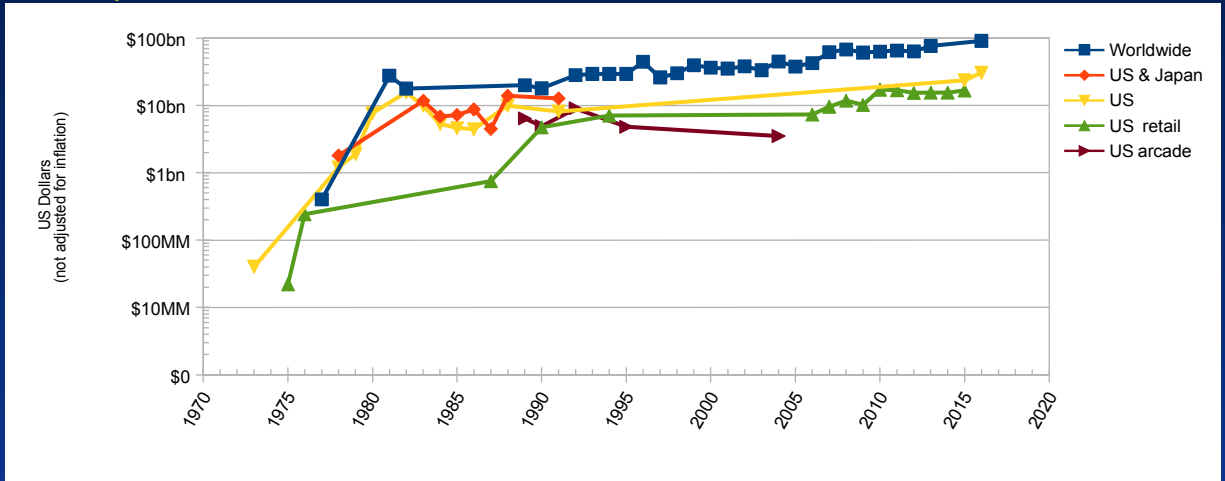
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Interactive Entertainment: Big Market, Continued Growth



Timeline shows constant growth, with notable exceptions:

1978 Space Invaders arcade game caused a coin shortage in Japan

1981 arcade games earned more than twice box office

1983 video game crash

1994 arcade renaissance?

Home games sales are comparable to home video, with network-delivered analogues.

Worldwide revenue from interactive entertainment (games) is comparable to that of non-interactive (filmed) entertainment.

Yet, how many people know or pay attention?

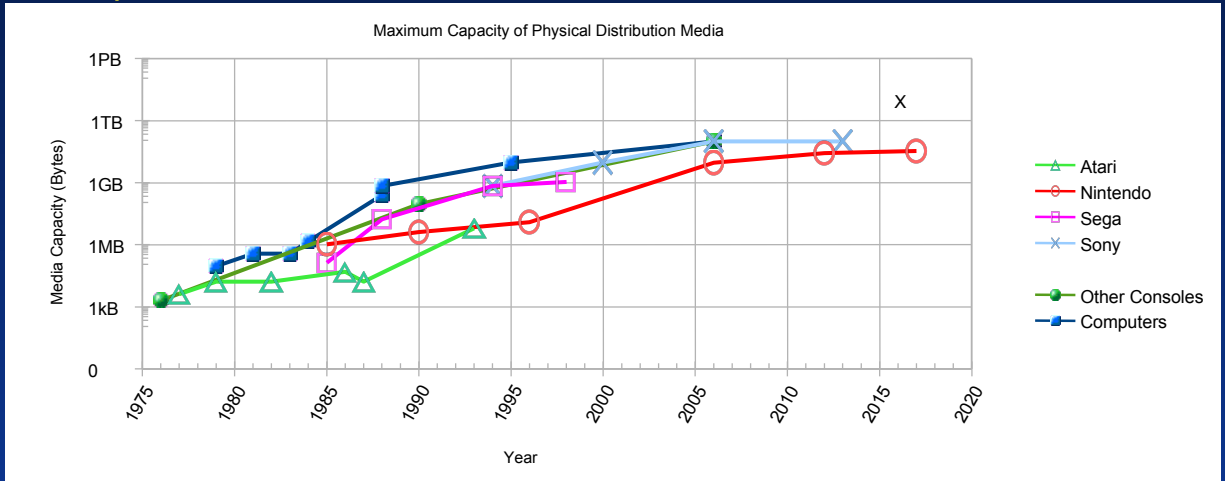
Sources include:

< http://vgsales.wikia.com/wiki/Video_game_industry >

< <http://essentialfacts.theesa.com/Essential-Facts-2016.pdf> >



Interactive Entertainment: Hungry for Memory



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New generations of game systems emerge about every 5 years
(design-in opportunities)

Exceptions to the curves:

Atari consoles lagged too long

NeXT magneto-optical was behind

Super Nintendo fell behind, as did the Nintendo 64 with its gamble on stacked-die technology

Recent migration toward common technologies (i.e. SD cards)

Distribution media size is reaching a plateau (32GB cartridges, 100GB disc)

- not keeping up with technology (no technical or economic reasons?)
- may be affected by online distribution (Internet/WWW)
- may be affected by lessening number of ROM makers

My 2015 "Retro VGS" project demonstrated strong continued interest in cartridge-based games, technical and economic feasibility of cartridges with wide bus and large capacity (extending curves to "X")

Nintendo 2015 patent application for new system with cartridge ("NX", released 2017 as "Switch"). Did we poke the bear? Maybe

Let's punch through that terabyte ceiling!



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Game developers are your friends! They want more capacity



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I'd like to be able to scale data bus widths again