Is Gaming Changing the Storage Architecture Landscape

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Agenda

- Gaming Overview
- Storage
- Cloud Gaming
Introduction
GAMING IS EVERYWHERE

<1 Billion INSTALL BASE AND GROWING

PCs  |  Macs  |  Consoles  |  Cloud  |  Mobile
GAMERS WANT

- Fast Frame Rates
- High Visual Quality
- Responsiveness
- Social and Streaming
- Broad Ecosystem Support
$35.7 BILLION
PC GAMES REVENUE

SOURCE: Newzoo 2019
>$1 BILLION

ESPORTS REVENUE

SOURCE: Newzoo 2019
>1 BILLION HOURS
VIEWED EVERY MONTH

SOURCE: Statista 2020
Storage Architecture
MODERN WORKLOADS REQUIRE MORE STORAGE

VIDEO GAME INSTALL SIZES: 2000 - PRESENT

THE BIGGEST PC GAMES FROM 2000 TO 2020

https://www.systemrequirementslab.com/cyri
https://www.pugetsystems.com/recommended/Recommended-Systems-for-DaVinci-Resolve-187/Hardware-Recommendations
NVME SOLID STATE
STORAGE TECHNOLOGY IN GAMING

LOADING
- Faster gaming load times – more time playing and less time waiting!
- Increased chance at first strikes
- More seamless gaming experience

COOLING
- SSDs can reduce the amount of cooling needed for gaming
- More energy efficient
- Quieter

DURABILITY
- SSDs More durable and reliable than HDDs
- Longer MTTF
Today’s Loading

Dynamic Texture Loading
- Human focus
- Performance degradation
- Fetching texture w/o blowing up DRAM

Error Recovery Flow
- Reliability
- Checkpoints & Instruction level Faults

Compression
- Reduce the size of built assets
- Optimize data path and bandwidth
- Effective Capacity Optimization
New Storage Architecture for Gaming

- Tiered storage with Gaming AI
- Computational storage
- More sophisticated compression
- RAID 10
Tiered SSDs w/ Gaming AI

SSD NAND is divided into two pools: SLC and QLC by the SSD controller firmware.

Gaming AI software has DIRECT access to the two types of NAND flash:
- SLC = high performance and endurance
- QLC = high capacity, low endurance

Data is intelligently and continuously balanced across SLC or QLC by Gaming AI software:
- Heavy traffic => SLC
- Light traffic => QLC

SLC is smart provisioned on the fly.

Enmotus Machine Intelligent Software

OS or User Data and Files

20G-128GB Fixed allocation of static SLC 30K+ P/E

Standard SLC cached QLC 300-1600 P/E
Maintaining Consistent IO Performance

Maintain consistent performance by remapping high traffic areas to SLC in real time.

Conventional TLC/QLC SSDs drop off in performance as the device fills up.

Percentage of Device Used

Performance
Single-chip solution reduces latency and improves results
Cloud Architecture
CLOUD GAMING
GOOGLE STADIA & MICROSOFT XCLoud

LOCATION
The console or “box” lives in the data center.
Access your game console from any device
Google deploys ‘gaming servers’ w/ AMD cloud-optimized datacenter GPUs
Microsoft literally has consoles in Azure datacenters w/ AMD cloud-optimized GPUs & RyCPUs

ON-DEMAND
Similar to video on demand – A series of compressed video frames
But video is reacting to the gamer’s inputs at 20-60 frames per second.
Game is stored, executed, and rendered by the service provider
Video is streamed directly to the enthusiast’s computer, console or mobile device
Leaving Peer-to-Peer Gaming in the past
Creators changing how games are created

- On-Demand Gaming
  - Streaming
  - Loading on-demand – fetch data as needed without ‘blowing up’ DRAM
- Ray tracing – Extra level of realism
- Human focus Factor - peripheral drop in detail
- Cloud Gaming Data Compression
Google On-Demand Cloud Gaming

https://cloud.google.com/solutions/gaming/cloud-game-infrastructure
Cloud Gaming Data Compression

- Lots of time spent waiting for downloads to finish
- Downloads
  - gaming servers with CDN or edge services
  - Performance depends on bandwidth and a good compression algorithm
  - Compression ratio and decompression speed is key
    - A stronger compression algorithm will aid in decompression speed
  - Computational storage could accelerate decompression rates for faster game play on devices

![Diagram of Cloud Gaming Data Compression](image)
Loading Solutions Considerations

Direct storage APIs
- Compression
- Dynamic Loading

Optimize
- Error Recovery Flow
- Garbage collection algorithms
- Dynamic caching – doesn’t work well for gaming, impacts reload times
- Reloading issue
MODERN WORKLOADS REQUIRE MORE MEMORY

CREATION
REQUIRES MORE MEMORY
DAVINCI RESOLVE

GAMING
REQUIREMENTS ARE RISING
BATTLEFIELD SERIES

MINIMUM VIDEO MEMORY (GB)

1080p
4K
6K/8K

4 GB
8 GB
11 GB+

RECOMMENDED VIDEO MEMORY (GB)


Bad Company
Battlefield 1
Battlefield 2
Battlefield 3
Battlefield 4
Battlefield V

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2020 is the year of the Gamer
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