



AI's Data Tsunami: Innovative data management storage solutions and SMR drives

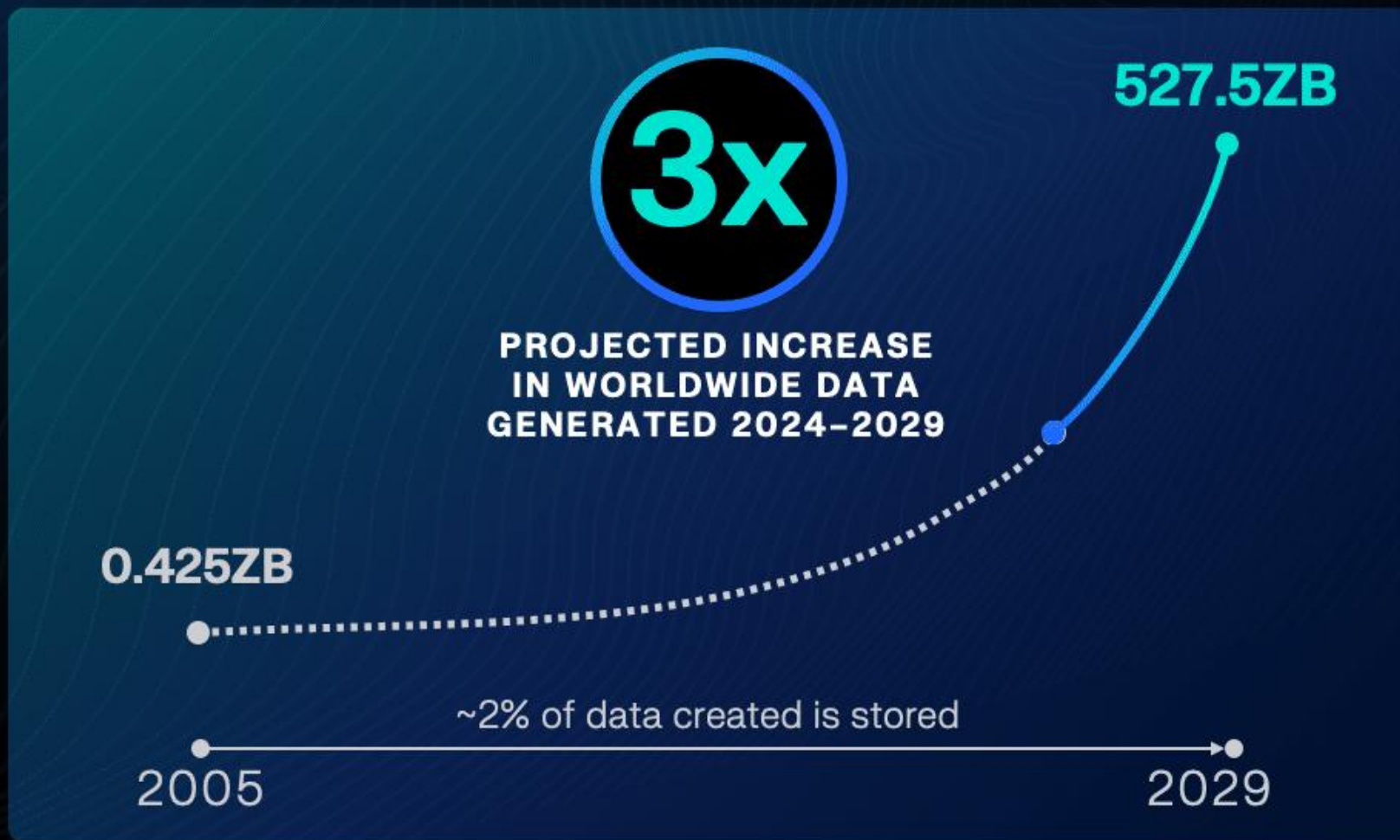
Simplified • Efficient • Sustainable

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Member of
WORLD ALLIANCE
for EFFICIENT SOLUTIONS | **by SOLARIMPULSE**
FOUNDATION

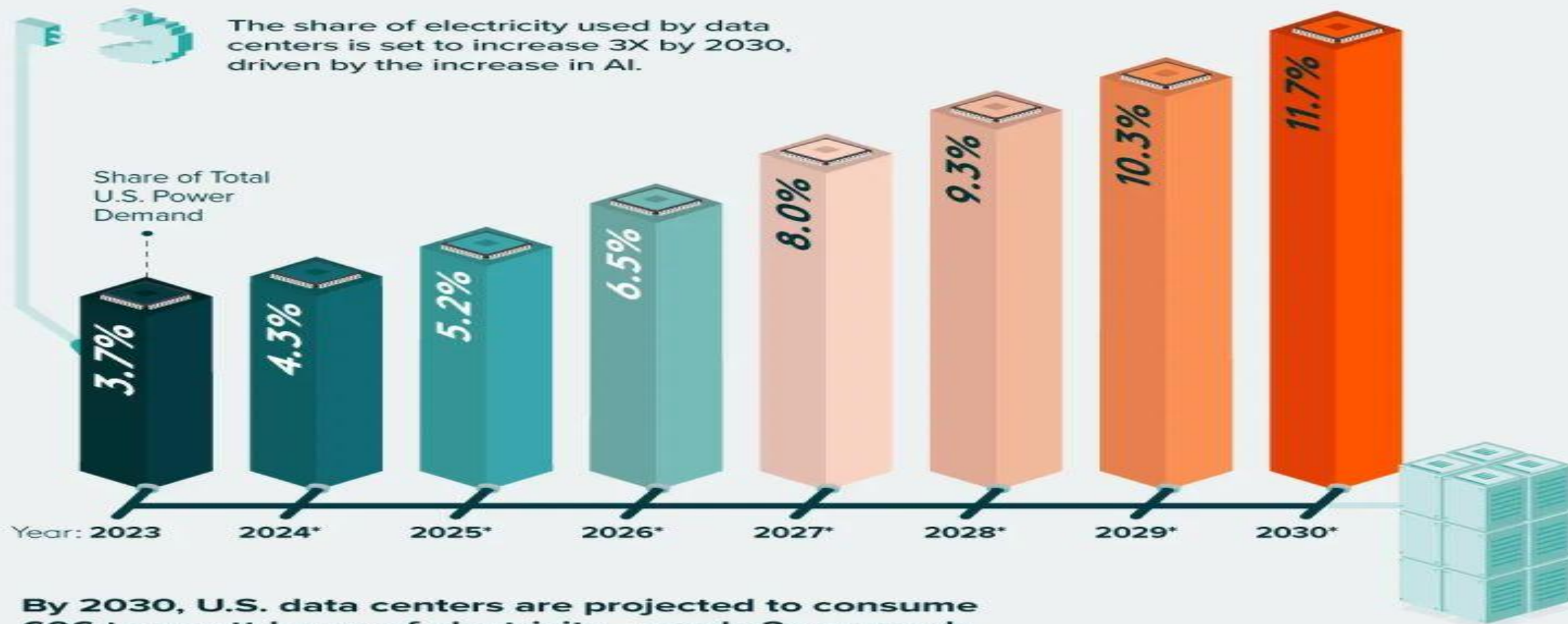


Data Generated Will See **Massive Growth**



Source: Worldwide IDC Global DataSphere Forecast, 2025-2029, doc #US53363625, May 2025

THE RISING SHARE OF U.S. POWER CONSUMED BY DATA CENTERS, 2023–2030



By 2030, U.S. data centers are projected to consume 606 terawatt-hours of electricity—nearly 2x as much as the UK used in 2023.



Data has an Environmental Footprint

We contribute to it EVERYDAY

“...sending 1 email with an attachment produces the same Carbon emissions as 1 small plastic bag...”

- BBC News report, 2020

“...a single AI query uses up a bottle of water for cooling ...”

REMEMBER THIS MESSAGE?

“Time is running out for millions of Microsoft Windows 10 users — here's what you must do before the deadline.”

Omdia estimates there are **550 million machines** in corporations that still use Windows 10, and half of these can't upgrade to Windows 11

THE RESULT: MORE CAPEX & E-WASTE

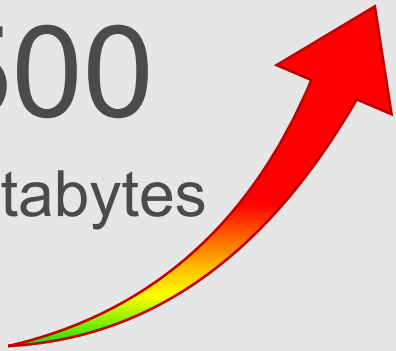


Data Explosion Overwhelming Storage

Today's data infrastructure is bloated & costly, with massive e-waste and OPEX from inefficient systems.

Exploding Data Volumes

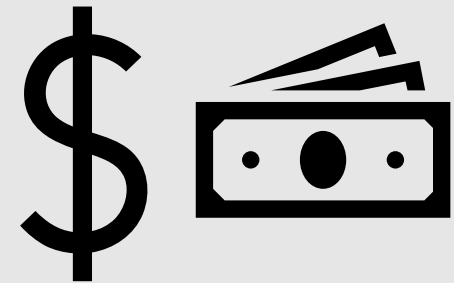
500
Zettabytes



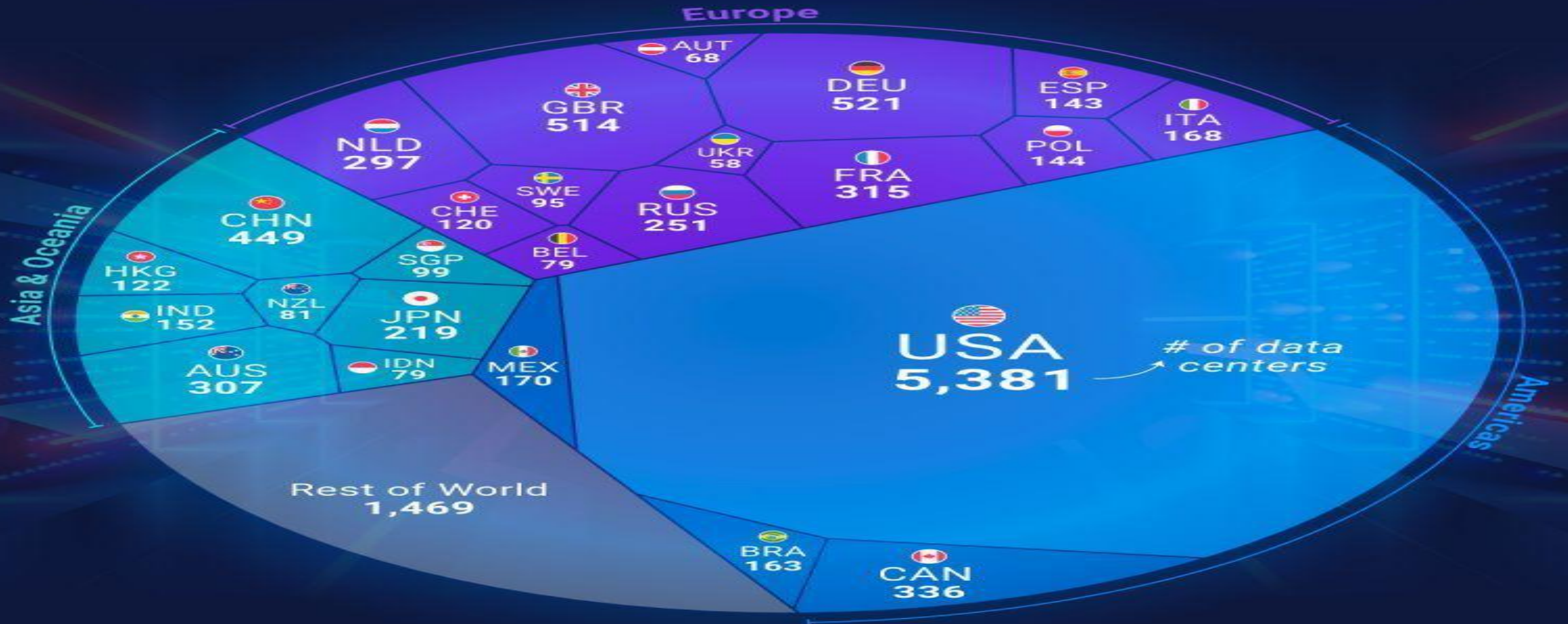
Skyrocketing Energy & E-Waste



High OPEX & CAPEX



THE WORLD HAS 11,800 DATA CENTERS



 **VISUAL CAPITALIST**

 **voronoi**
BY VISUAL CAPITALIST

Where Data Tells the Story

Rest of World may also include countries from these regions. Cutoff is at rank 25 (Ukraine). As of March 2024. Source: Cloudscene, Statista

 Download on the
App Store

 GET IT ON
Google Play

 **SWISS VAULT**

DATA CENTER PROJECTS

RECENT ANNOUNCEMENTS

 Microsoft **Microsoft \$110B Expansion Plan**



OpenAI Launches \$10B Texas Stargate Campus

The Oracle logo, featuring the word "ORACLE" in red capital letters.

Oracle to Build over 100 Data Centers



NVIDIA®

NVIDIA-Deutsche Plan \$1B Germany Data Center

 Meta

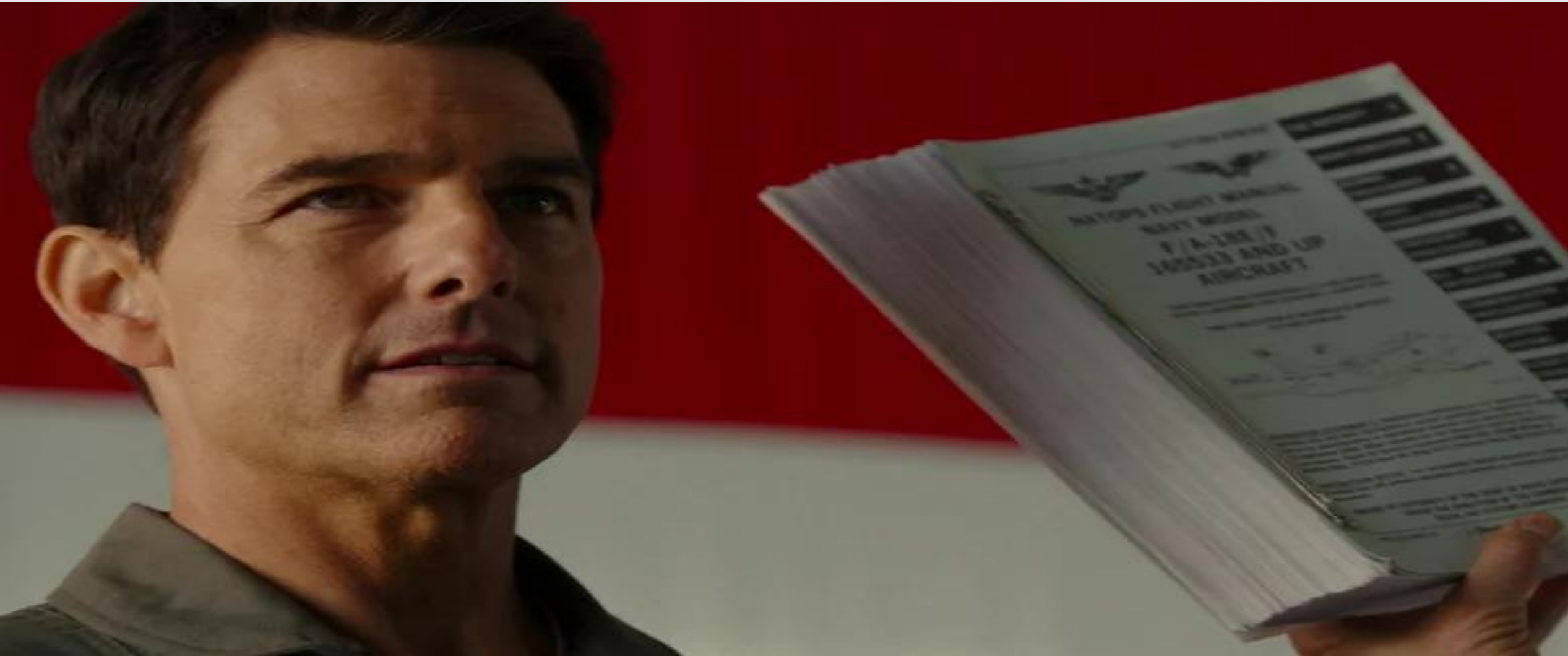
Meta selects Louisiana for \$10B Data Center

Just this week...

AI boom could 'break' global power grid **Buffet, Musk and Zuckerberg warn**



The Data Center Manual is Being Rewritten



THE NEW DATA CENTER MANUAL

META spent \$70 Million Tore down for AI workloads

- Outdated design after 2-3 yrs.
- Adopting the “miners” concepts
- Future Proof design
- Needed higher density
- Liquid cooling
- Massive Power Needs
- Retrofitting facilities for AI
- Seeking greater efficiency



IT Requires Innovative Solutions...NOW!

Hardware:

- higher densities for AI - greater data volumes
- uses more and more energy
- racks over 100kw requiring water cooled systems
- sever refresh every 3-4 years – generates e-waste

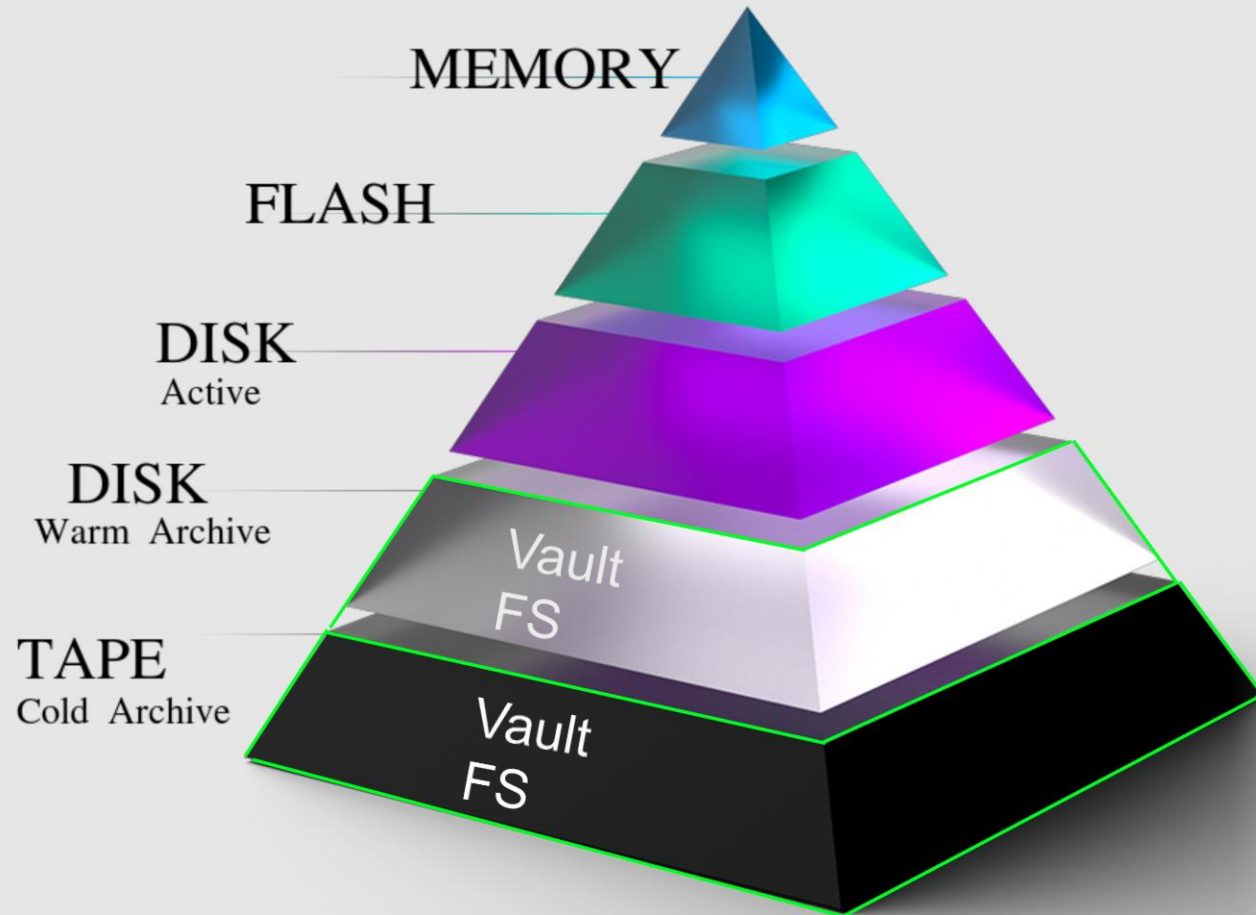


Software:

- reduce hardware need – extend hardware life
- self healing and automated data backups
- resilient data across distributed systems (high availability)
- reduce overhead costs and DR for managing data

Vault File System for Active Archive Data

On-Prem • Edge Data • Cloud



100 Year Active Archive Data Storage

- AI & LLM Training
- Healthcare
- Government
- Aerospace
- Banking / Finance
- Research
- Media

HARDWARE

SMR & CMR DRIVES

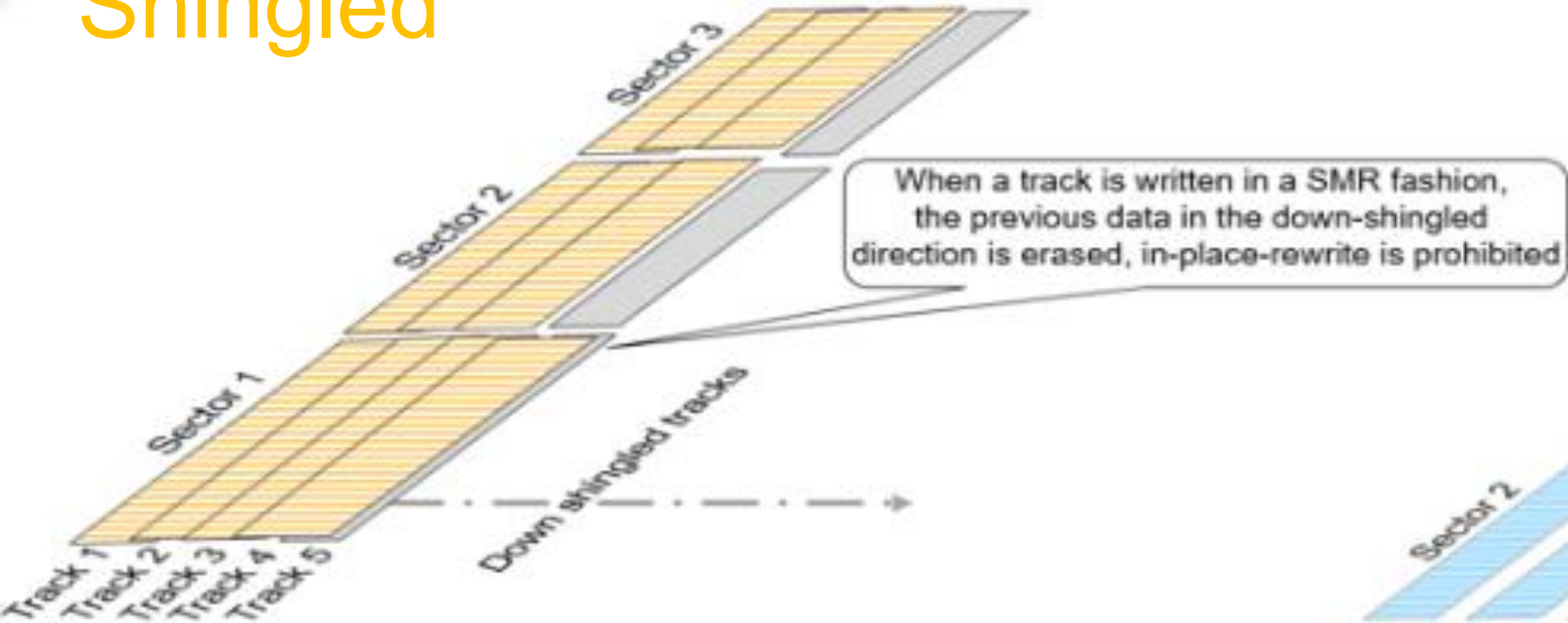
Requires Proprietary Software and Firmware

The Hyperscale Company **SECRET...**

Shingled Magnetic Recording Hi-Capacity Drives (SMR vs CMR)

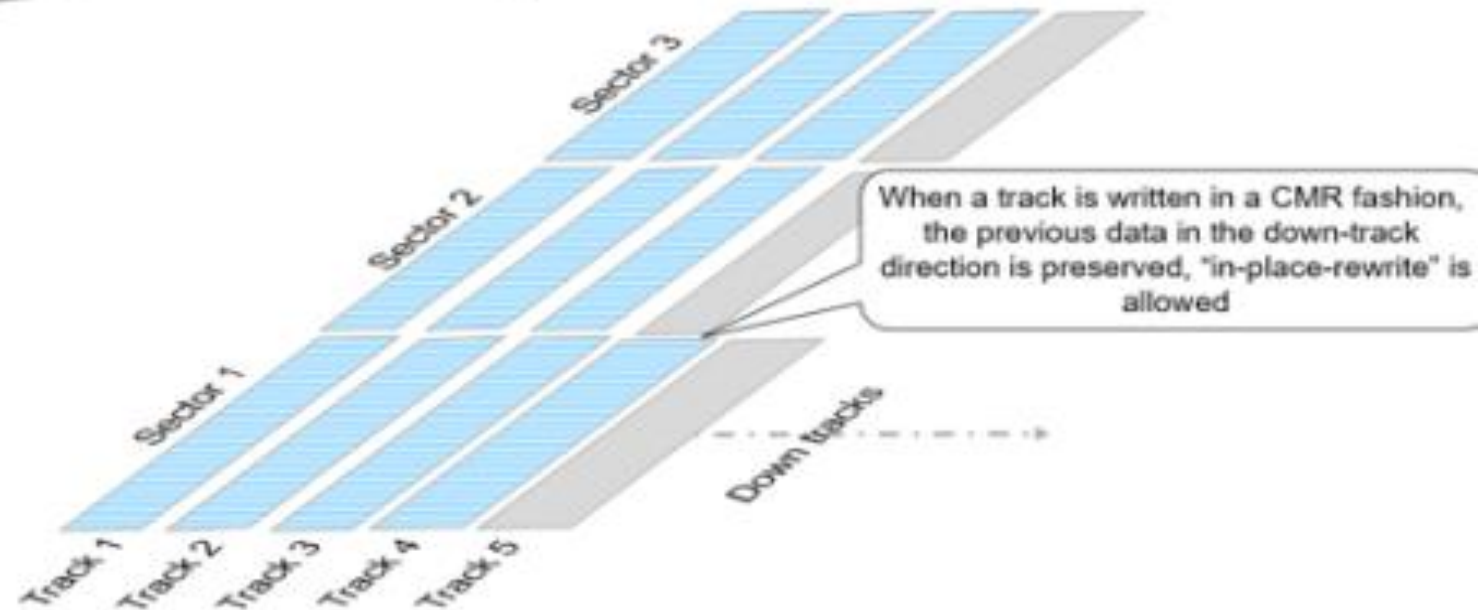
Shingled

Conventional



SMR Architecture

CMR Architecture



CMR vs SMR* Comparison

| FEATURE | CMR | SMR |
|--------------|---------------|-----------------------------------|
| COST PER TB | HIGHER | LOWER (saves space & energy) |
| WRITE SPEEDS | FASTER | SLOWER |
| READ SPEEDS | SLOWER | FASTER (with parallelization) |
| IDEAL USAGE | MULTI-TASKING | ARCHIVAL – ACTIVE ACCESS |
| DENSITY | LOWER | HIGHER (20-30% more - same space) |

*** ONLY AVAILABLE TO HYPERSCALE COMPANIES**

SOFTWARE

Swiss Vault's VaultFS

“Is a GAME CHANGER”

Unlocks SMR's for Everyone

File Systems

TYPE 1: Traditional File Replication Management

RAID 1P or 2P Limited!

1 PB

Backup #1

1 PB

Backup #2

1 PB

Total

3.0 PB

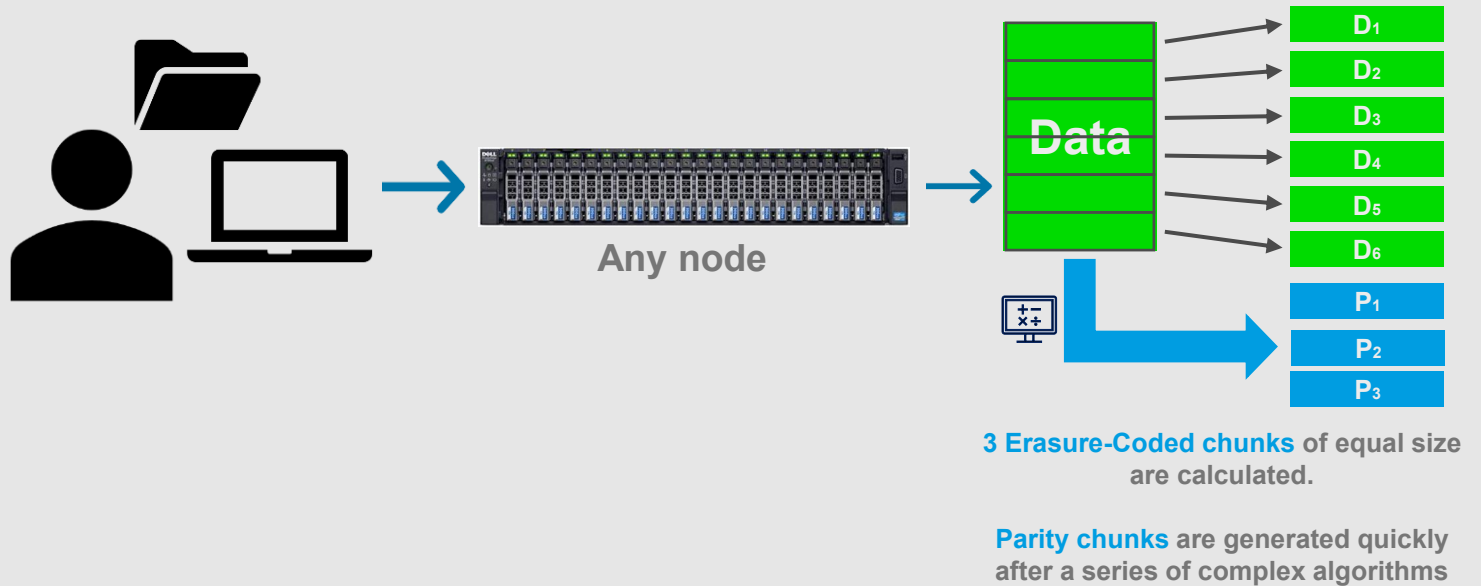
**200% Hardware
Overhead**

TYPE 2 – Network Based

Erasure Coding: Parallel & Distributed

Swiss Vault File System- VaultFS (VFS) Ex.6D+3P

Data is transferred from
client to
Vault File System (VFS)



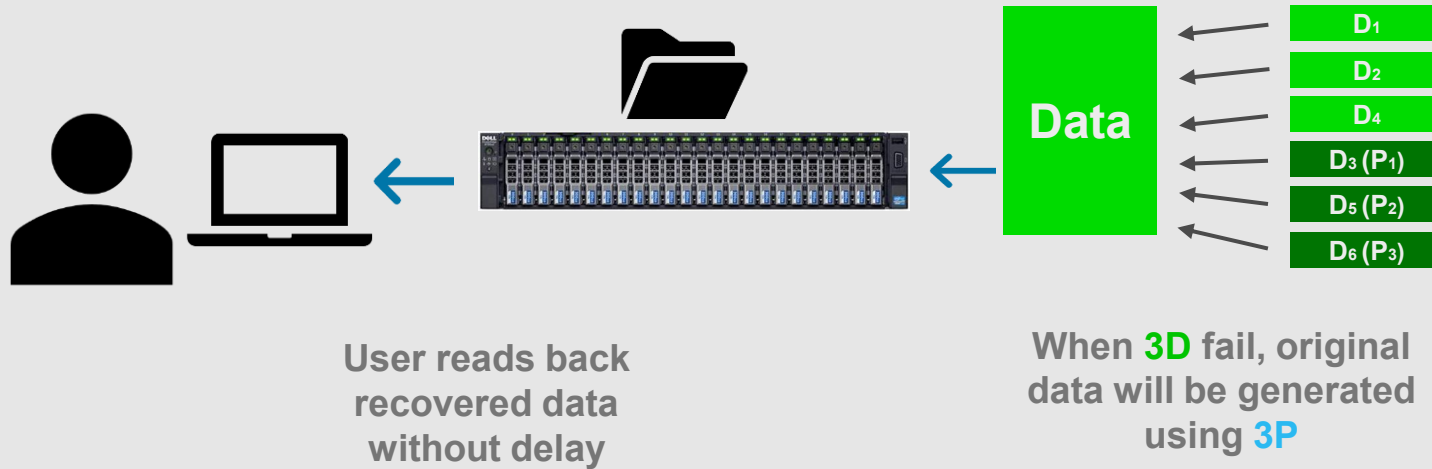
No replication required!



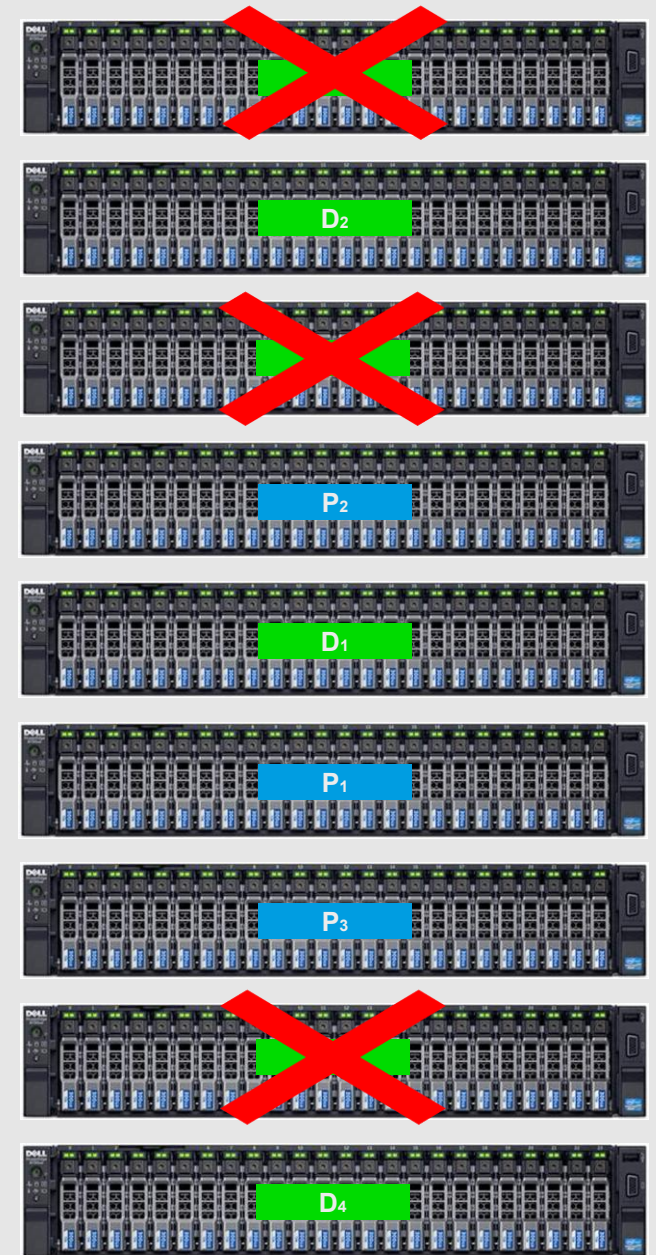
Erasure Coding: Parallel & Distributed

Swiss Vault File System- VaultFS (VFS) Ex.6D+3P

- Checksum failure, or
- Loss of disk, or
- Loss of node



No replication required!



VaultFS = Optimized Space, Less Volume Higher Resiliency

RAID 1P or 2P Limited!

1 PB

Backup #1

1 PB

Backup #2

1 PB

Total

3.0 PB

**200% Hardware
Overhead**

VFS 120D + 6P

Data Chunks

0.008 PB

0.008 PB

0.008 PB

0.008 PB

0.008 PB

0.008 PB

0.008 PB

0.008 PB

...120 D

Parity Chunks

0.008 PB

0.008 PB

0.008 PB

0.008 PB

0.008 PB

0.008 PB

1.05 PB

**5% Hardware
Overhead**

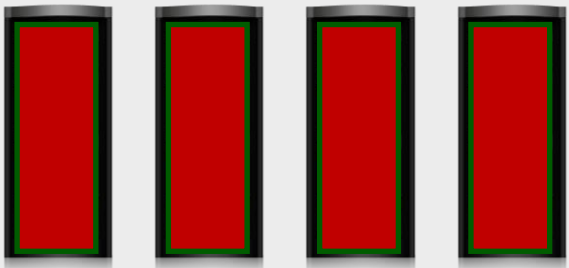
Higher levels of data robustness – but using only half of the additional data storage space.

Genomic Use Case

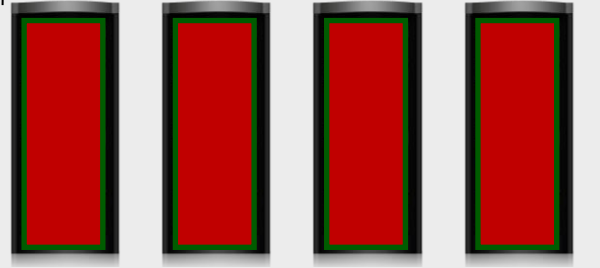
Free-up Space & Increase Resiliency

Storage of **10 PetaBytes** data using **RAID** on *hyperconverged* racks,  = 2.5 PB/rack

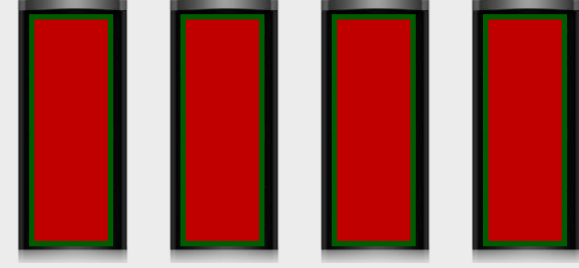
10 PB Raw Data



10 PB Backup #1



10 PB Backup #2



30
PetaBytes used
0 Free
PetaBytes

Install **VaultFS** on above servers with $8 D + 4 P$, data will migrate to this result:

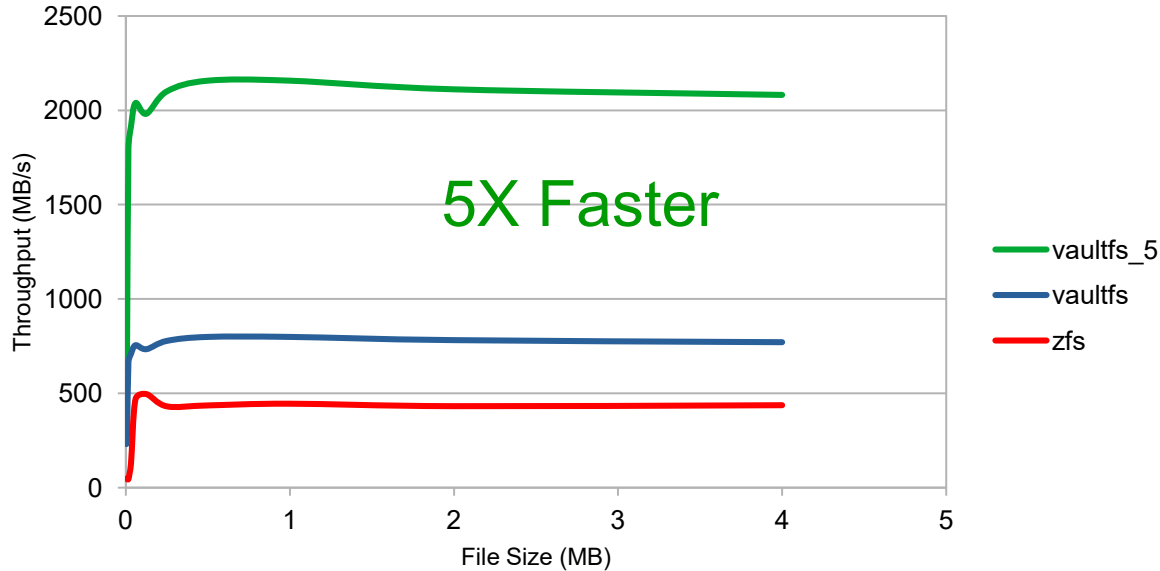


15
PetaBytes used
15 Free
PetaBytes

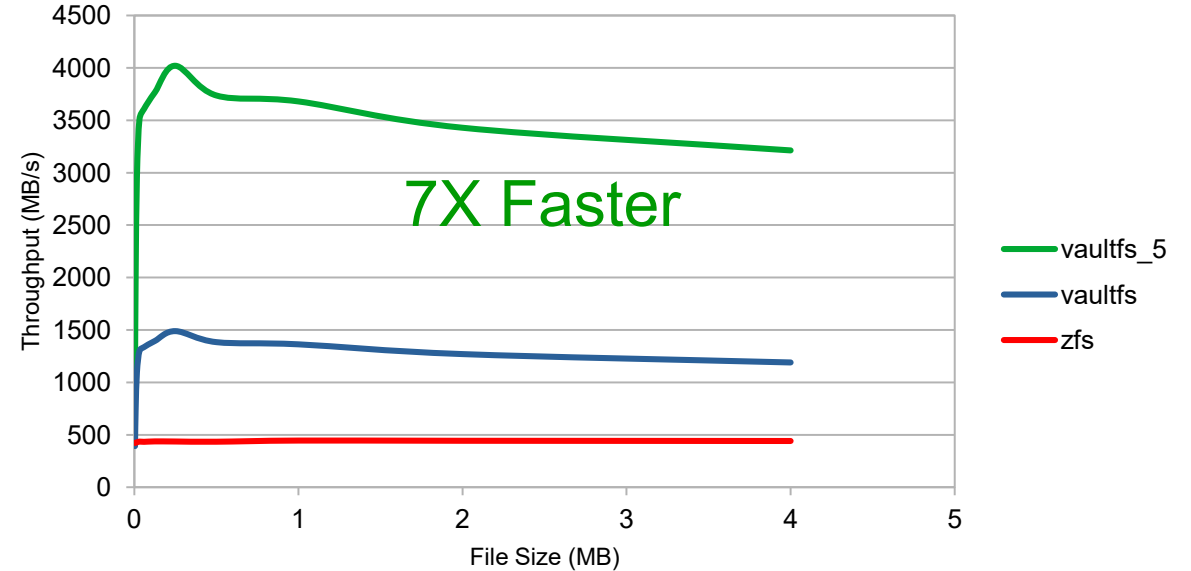
- 50% hardware savings • 2X increase in resiliency • Energy savings

VFS Offers Faster Data Speeds

Single & Multi Node Write Throughput



Single & Multi Node Read Throughput

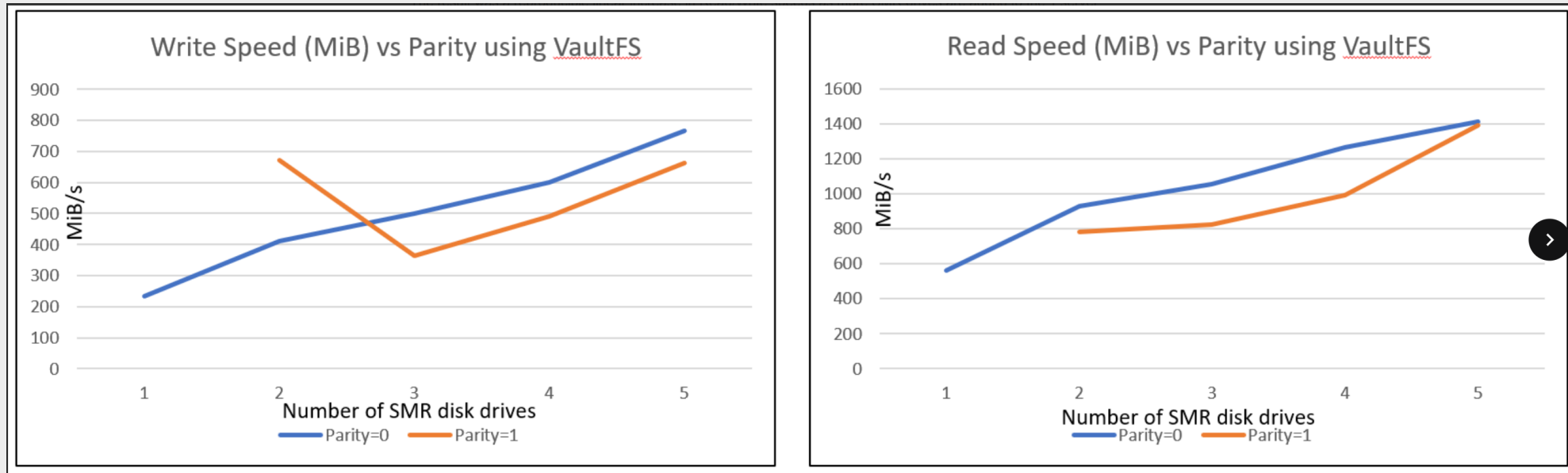


ZFS vs VaultFS (DELL PowerEdge R730xd)

| | |
|-----------------|---|
| Number of disks | 12*5 |
| DISK | 5TB Seagate ST5000LM000-2AN170 HDD NMRR:5526 |
| RAM | 4x 16GB 2400MT/s DDR4 |
| CPU | 56x Intel(R) Xeon(R) CPU E5-2680 v4 @ 2.40GHz |

Shingled Magnetic Recording Drives

VaultFS works out of the box with high density SMR drives with few errors



- 30 TB data density (50TB/disk in development)
- VaultFS linear increase of Write / Read speeds (adding more drives or more Nodes)
- Few errors (6 extents errors with VaultFS vs. 152,354 with ZFS)

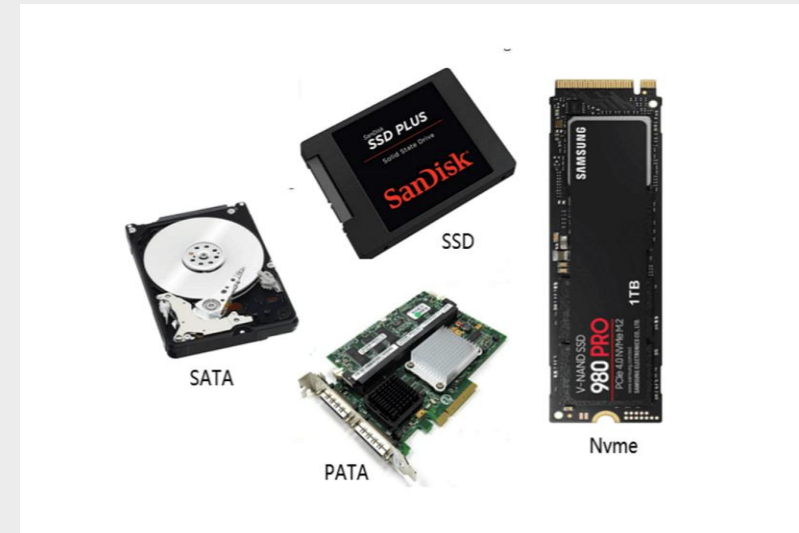
Media Flexibility is a MUST

Vendor Lock-in is a Problem

VaultFS
is the Key

- Any type of server
- No hardware accelerators required
- Use to end of life

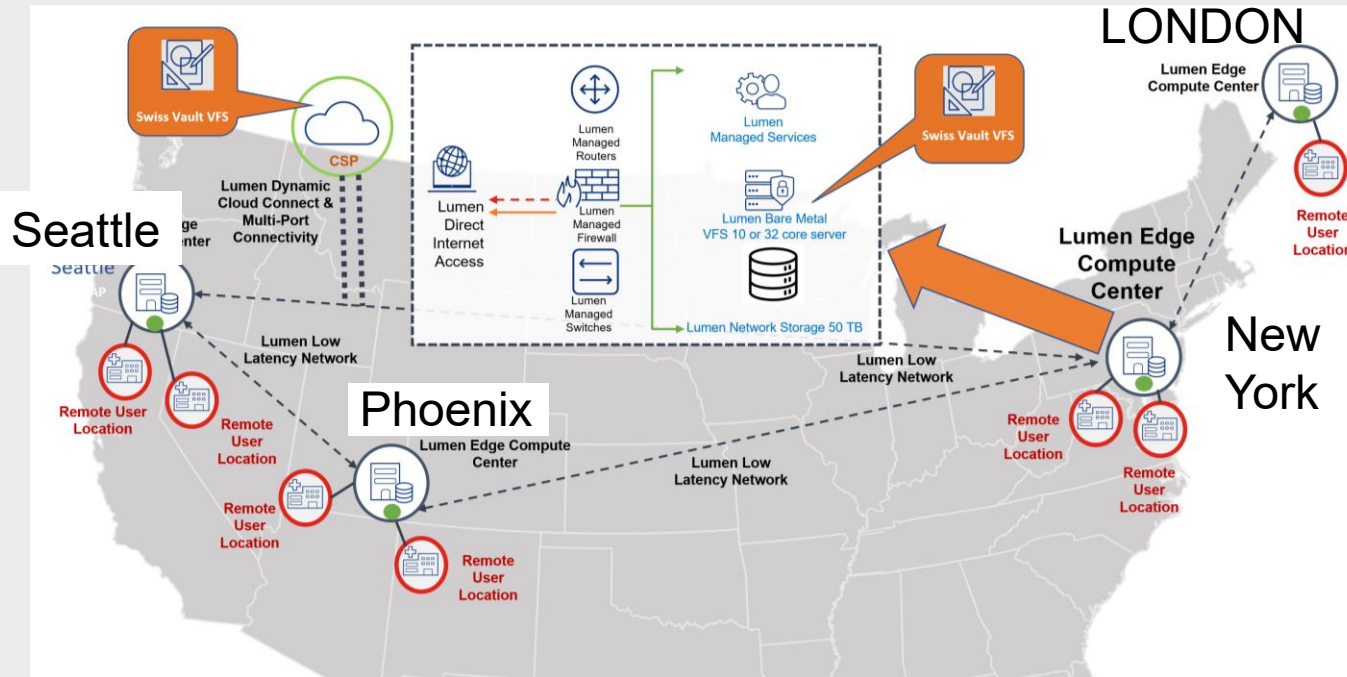
- Any SMR or CMR data media
- Any volume or size
- Use to end of life



Growing IT Requirements

Distributed Terrestrial Data

File Sharing for DR and risk management, global data availability



File transfer rate

| | |
|---|-----------------------------------|
| Latency | 70 milliseconds |
| Default TCP window size in bytes | 1'048'576 bytes (~1 MB) |
| Expected data transmission rate | 15 Megabytes/sec |
| Measured data transmission rate with Vault FS | 150 Megabytes/sec 10X speed up |

- Connected 4 data centers on 2 continents
- Set-up time 10 minutes

- Achieved 10X data transmission speed-up

Most Sustainable Modular Data Center

- Partnership with Kais-AIR / Bladeroom
- Sustainable Data at Edge

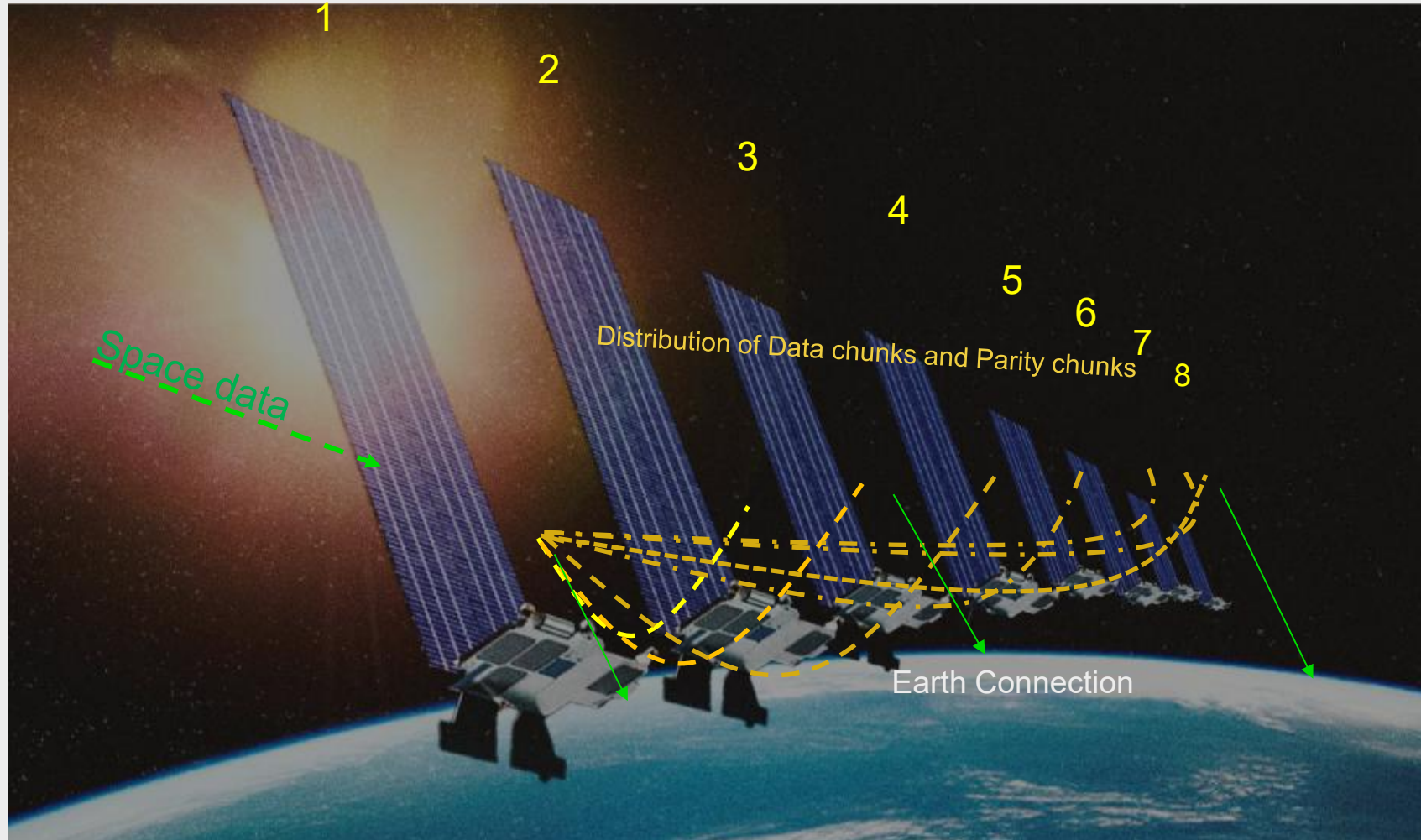


SPACE Data Storage The Next Frontier



TERRESTRIAL to CELESTIAL NETWORKS

Resilient Data in Space



Vault File System Distributed Data

Each Satellite acts as a Node

- Can lose satellites, but data is always available
- Fast data transfer in parallel processing

FINAL MESSAGE

As Top Gun Maverick Said...

“IT’S NOT THE PLANE IT’S THE PILOT”

1. Change Requires New THINKING – address massive impacts of IT, AI & DATA

- Financial & Construction
- Utility & Water Resources
- Land & Environmental Costs

2. Innovative Designs - Manuals & Tools needed to:

- Reduce Energy, Carbon & Resources`
- Do more with LESS
- Extend life of equipment
- Reduce Farm Land Development

SWISS VAULT can help “PILOT”
Your HPC Future With VFS/SMR Technology



Thank you

Maximizing Data Efficiency with VFS & SMR's

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