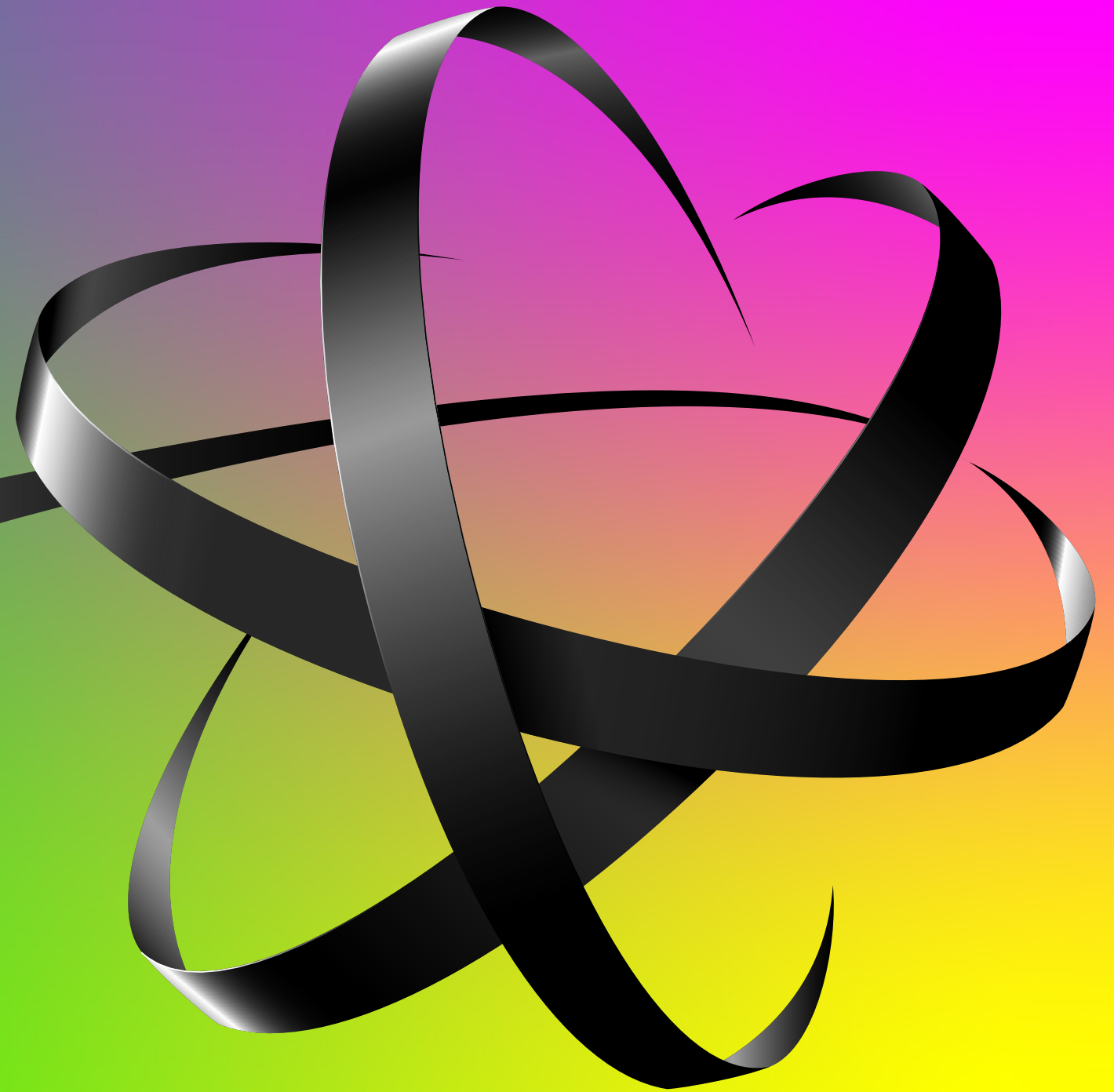FUJIFILM
Value from Innovation

Built on tape:
Your guide to unlocking cost-efficient, secure, and future-proofed data storage

Tape can do more for your organization than you realize

As the foundation of long-term data management strategies, tape enables organizations to build an efficient, robust, and secure approach to data archiving, data protection, and recovery. It's the key to unlocking innovative storage strategies for organizations challenged with growing volumes of valuable data.
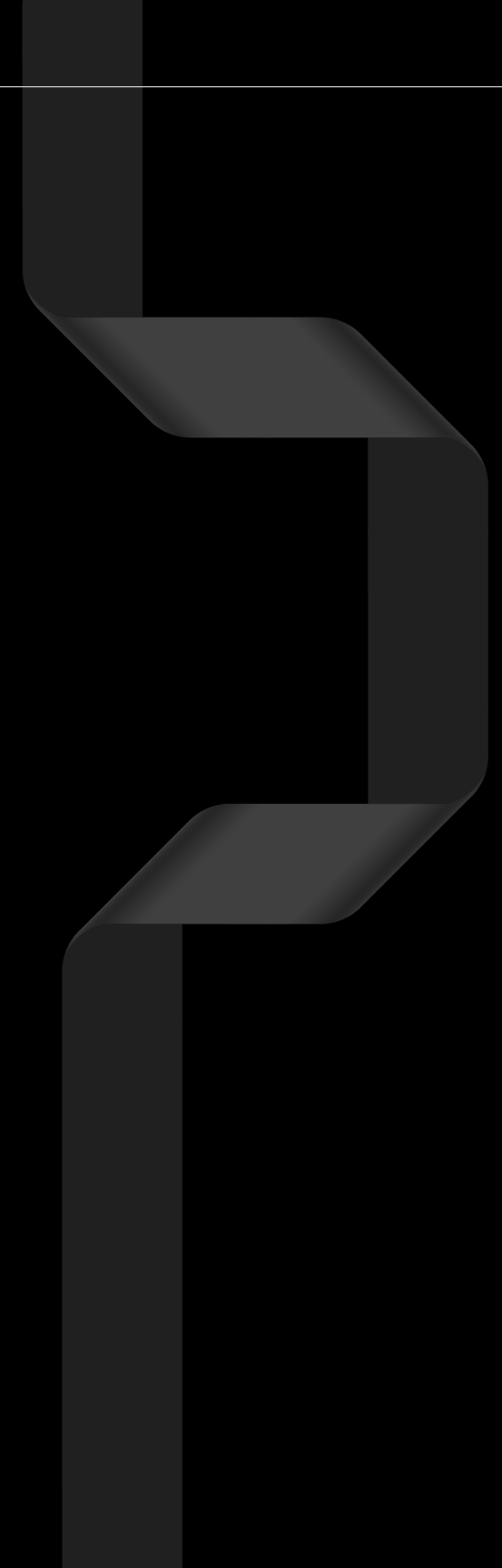
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01 The basics

01

Where does tape fit into your data storage ecosystem?

TIERING

The general rule of thumb for data storage is the 3-2-1 strategy. Put simply, there should always be three copies of data, on two different media, with one copy off-site for disaster recovery.

Depending on the type of information being stored, data can be categorized as hot, warm or cold.

Hot and warm data is business-critical and accessed most frequently—think real-time projects and customer queries. This type of data is usually kept on primary storage for quick user access.

Cold data, however, is information that needs to stay on file, but instant access isn't necessary. Although every business is different, cold data usually takes the form of HR files, completed projects and financial information. This is where businesses make use of tape drives—storage devices that read, write and record data on a magnetic tape.

So, when discussing archival tape data, for the most part, it's cold data that we're concerned with.

3-2-1 storage

Efficient data storage generally adheres to the 3-2-1 principle: there should be three copies of data, on two different media, with one off-site copy.

Hot Data

Kept on primary storage for easy access, hot data is business-critical, and often requires instant and frequent access.

Cold Data

Stored as backup or in archives, cold data is information that is retained for compliance, legal and data security reasons, with limited access.

01

TAPE FOR COLD DATA STORAGE
Tape is a data storage device that reads and writes data onto a magnetic tape—most common uses include for offline, backup and archival data storage.

Data protection and recovery with regards to tape typically involves creating periodic copies of raw data from one device (such as an SSD) onto a tape cartridge, so that data can be recovered in case of a data loss event.

Whereas tape archiving involves moving data from one storage device to an entirely different destination. This usually happens once the need to access said data decreases and the information is classified as cold, archival data.

Tape capacity
18 terabytes

Tape dimensions
Width: 12.65mm
Thickness: 5.2μm
Length per cartridge: 1,035m

FUJIFILM
Barium Ferrite
UK CA

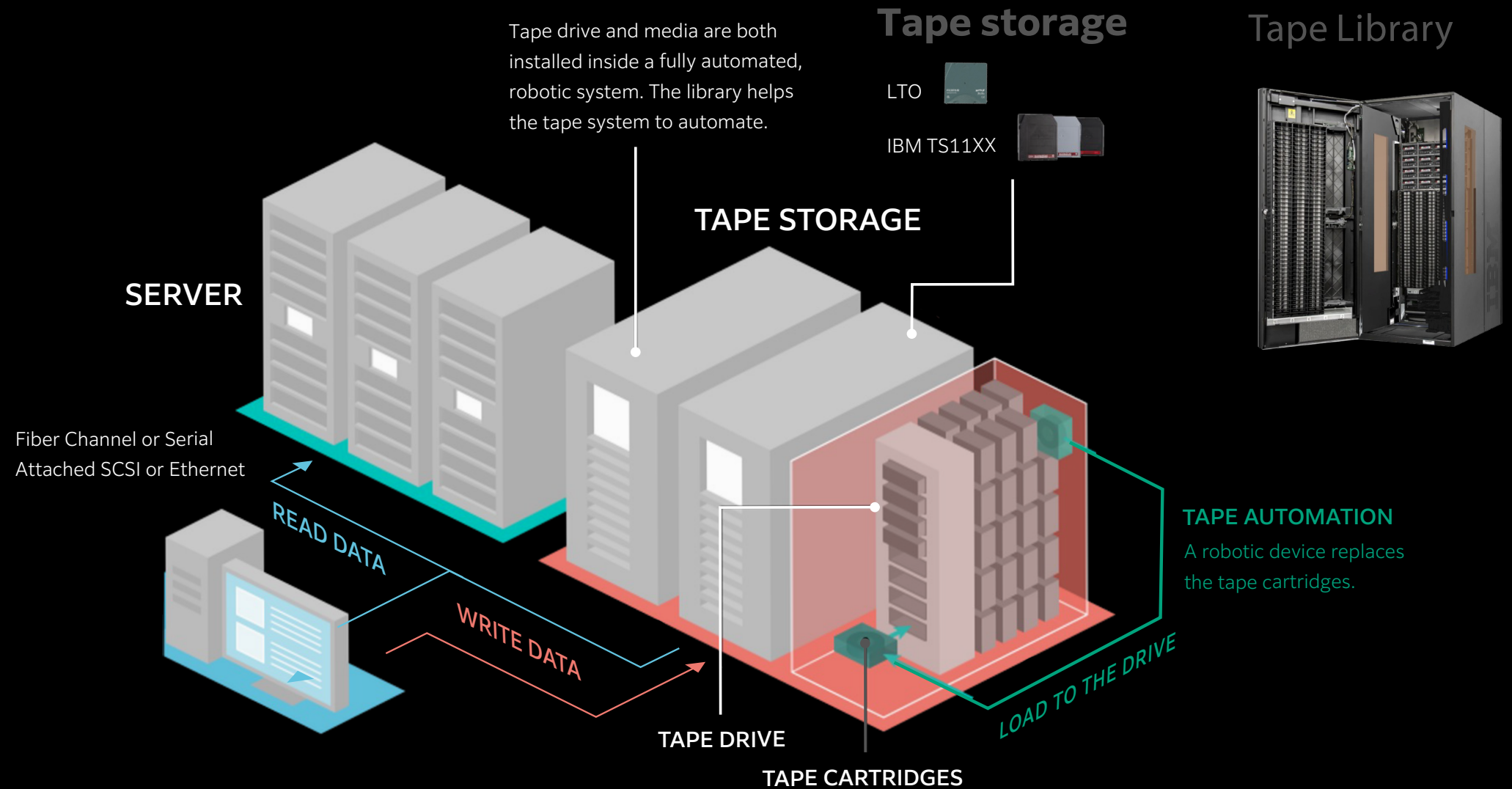ULTRIUM 9
18TB/45TB
NATIVE/COMPRESSED
CE
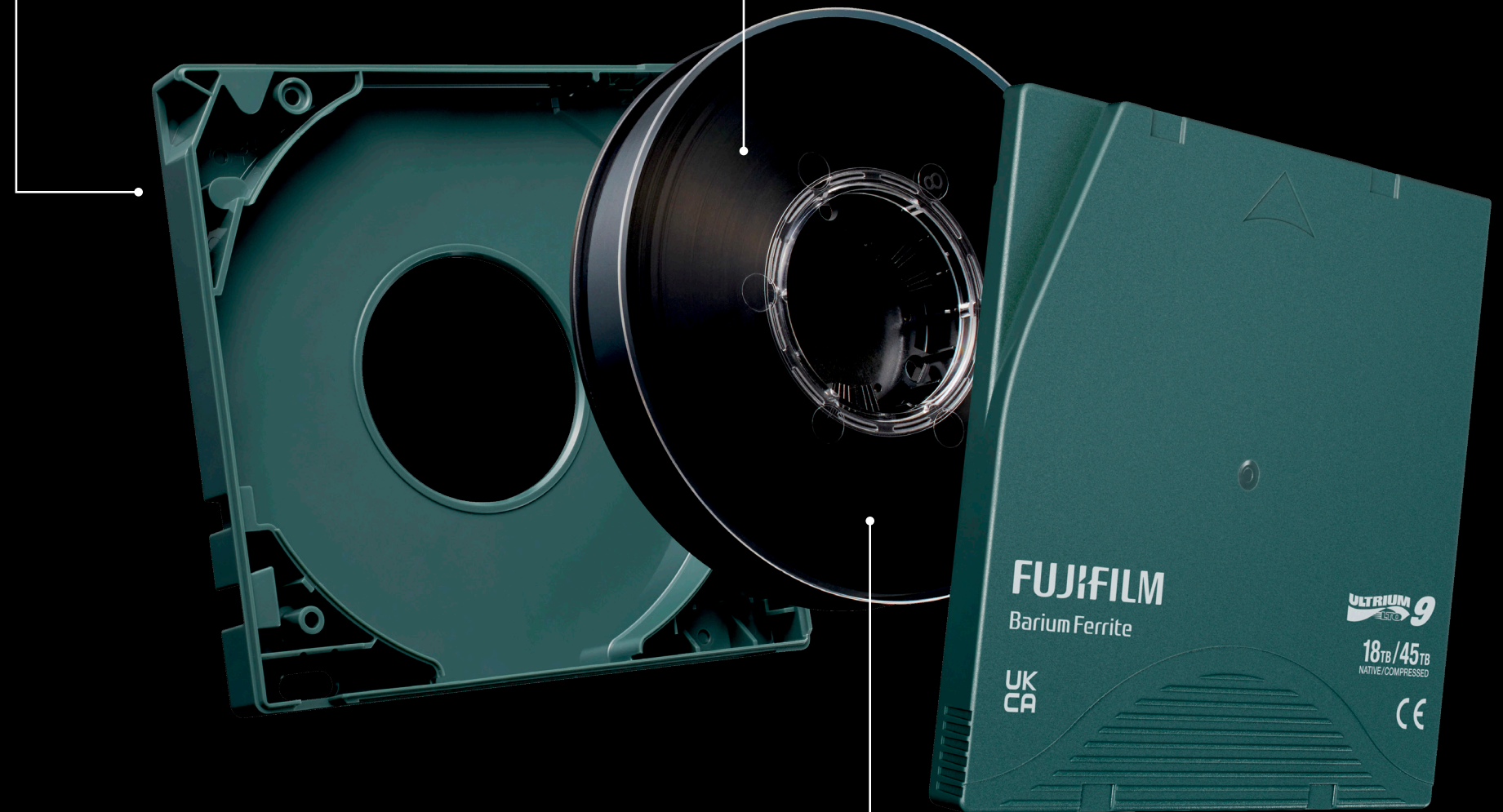
Average rewind rate
42 mph

01

How is tape storage used?

Tape storage is the most suitable device for storing cold data because of its high capacity, security, resilience and cost-efficiency. Inexpensive tape storage systems can be operated manually, while a higher capacity requirement can see you working with a fully automated system to save on manpower.

Example of a tape system

Tape drive and media are both installed inside a fully automated, robotic system. The library helps the tape system to automate.

Tape storage

LTO

IBM TS11XX

Tape Library

TAPE STORAGE

SERVER

Fiber Channel or Serial Attached SCSI or Ethernet

READ DATA

WRITE DATA

TAPE AUTOMATION
A robotic device replaces the tape cartridges.

LOAD TO THE DRIVE

TAPE DRIVE

TAPE CARTRIDGES

02 Why tape storage?

02

Challenges for businesses

REGULATORY REQUIREMENTS
In the US, most legal data must be kept on file for a minimum of ten years after its expiration. Failure to comply with laws and regulations typically results in not only lost data, but also large fines.

DATA RETENTION
The long retention periods challenge businesses needing archive systems because the solution must be both sustainable and cost effective. For companies that need to keep archival data on file, most methods of storage are expensive and have a short archival life.

DATA GROWTH
The rapid growth of data combined with long retention periods creates another challenge to archive systems: costs and maintenance. These costs apply to both procurement and installation, as well as the operating costs of long periods of archiving.

02

Benefits of tape storage

COST AND ENERGY EFFICIENCY

Compared to disk storage, the price of tape for data storage is much more affordable between and beyond a five-to-ten-year period.

The total cost of data storage decreases by 66% when businesses decide to migrate cold data to tape solutions over cloud and disk. This reflects an overall decrease in expenses such as admin and maintenance, energy, floor space and software charges.

Tape is also the more sustainable solution in relation to power consumption. Since tape only requires electricity when a tape is read or written, power consumption is much lower than that of disk storage.

RELIABILITY AND CONSISTENCY

Tape can help businesses achieve a lower error rate with Read while Write—written data is verified by the read head immediately after the data writing process. If the Read while Write operation finds an error, the drive will automatically rewrite the data.

Thanks to Error Correction Code, two parities are generated when the data is written in the buffer memory of the drive. If the data cannot be read after it's written on the tape, it reproduces the data from those two parities.

If a write error continues on the same track, the data cannot be recovered even with ECC technology. But because of interleaved protection, tape drives write sub-datasets in multiple locations, on different tracks: vertically and horizontally. This feature reduces the likelihood of read error due to physical damage.

02

Benefits of tape storage

LONG TERM STORAGE CAPABILITY
Disk storage failure usually occurs around five years after its first use, whereas the average lifespan of a tape is around 30–50 years.

Tape storage is perfect for storing data that not only needs to be kept on file for compliance reasons, but also isn't accessed on a regular basis. By 2025, 80% of all business data could be classified as archival.[1]

Businesses need to find somewhere for all that data to go, without incurring major cost or storage implications.

Tape is a smart and effective way to store vast amounts of necessary data for long periods of time with little maintenance or operational expense.

[1] www.enterprisestorageforum.com

02

Benefits of tape storage

OFF SITE STORAGE
Avoid cyber threats by creating an air gap.
This means that the tape is physically
disconnected from the network, and the data is
therefore protected from online threats.

Tape storage is immune to hackers and viruses
due to the nature of its portability. In fact, one of
the only ways to interfere with data stored on tape
is to physically damage the tape itself.

02

Who uses tape storage?

Among the many different users of tape, there are two main categories—ranging from end users such as large organizations to hyperscale users including large enterprises with multiple global subsidiaries.

End users

USERS WITH ON-PREMISE
DATA CENTERS

- Higher education
- Government
- Media & Entertainment
- Healthcare
- Manufacturing
- Finance

Hyperscale

CLOUD PROVIDERS
WITH ON-PREMISE
DATA CENTERS

- Cloud service providers
- Social media
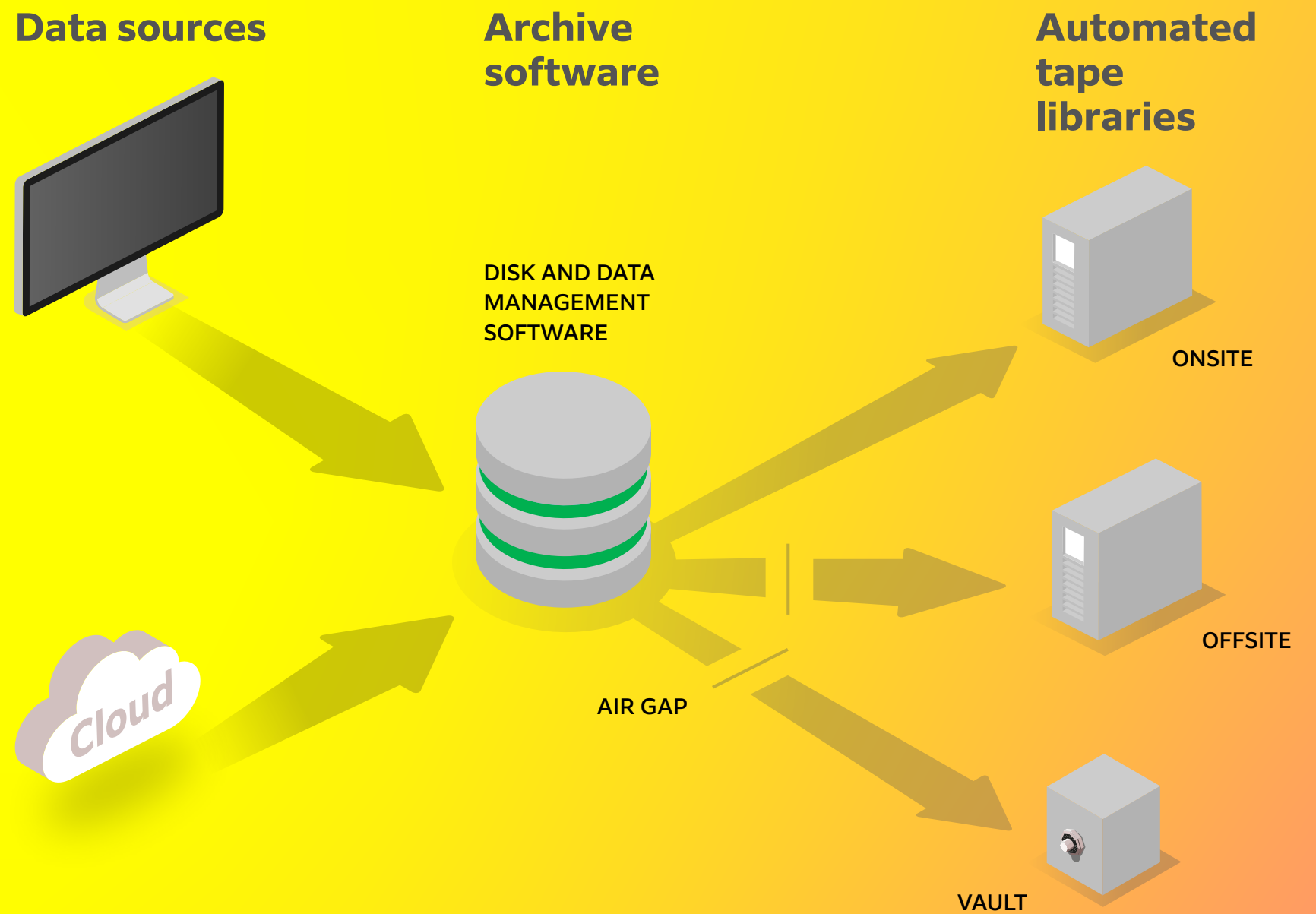- E-commerce and retail

03 Tape in action

03

Use case:
Long term data retention

Archive for compliance, preservation or storage optimization

Data loss prevention and compliance requirements are the main reasons that businesses permanently store data for long periods of time.

Data management best practices call for the storing of three copies of original data: two on different technologies, with one copy offsite and one copy offline. This method of data storage supports long term data retention.

By migrating data from HDD or flash drives to the archive tier on tape, users benefit from improved accessibility, enhanced security and digital preservation. Data stored on tape is the most environmentally sustainable dataset in the world while still providing better performance, cost, and reliability than cloud archiving.

Data sources

Archive software

Automated tape libraries

DISK AND DATA MANAGEMENT SOFTWARE

Cloud

AIR GAP

ONSITE

OFFSITE

VAULT

03

Use case:
Active Archive

Archive for occasional and seldom accessed data

A company uses Active Archive for the collection of data that is too valuable to discard, but is only accessed on an occasional basis.

Active Archive is created when data is migrated from Tier 0 to Tier 1 to Active Archive based on user-defined factors like file size, creation and last access. Upon access, data is restored to the cache on the Active Archive, and is then accessible to the user through Tier 0 and Tier 1.

The advantages of Active Archive include optimized storage costs, reduced environmental impact, legislative compliance and protection against data loss.
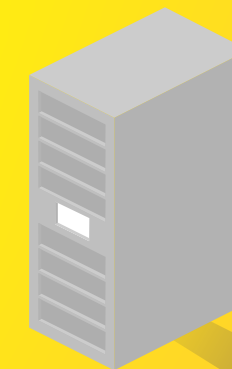
Data sources

Automated tape library

Intelligent Data
  Management Platform
Global Namespace
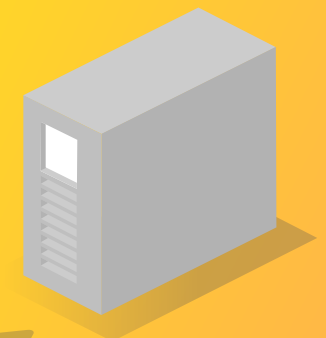Metadata/POSIX
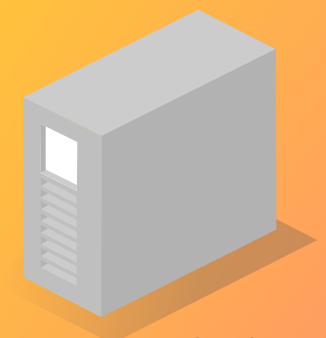Policy Based Tiering

TIER 0

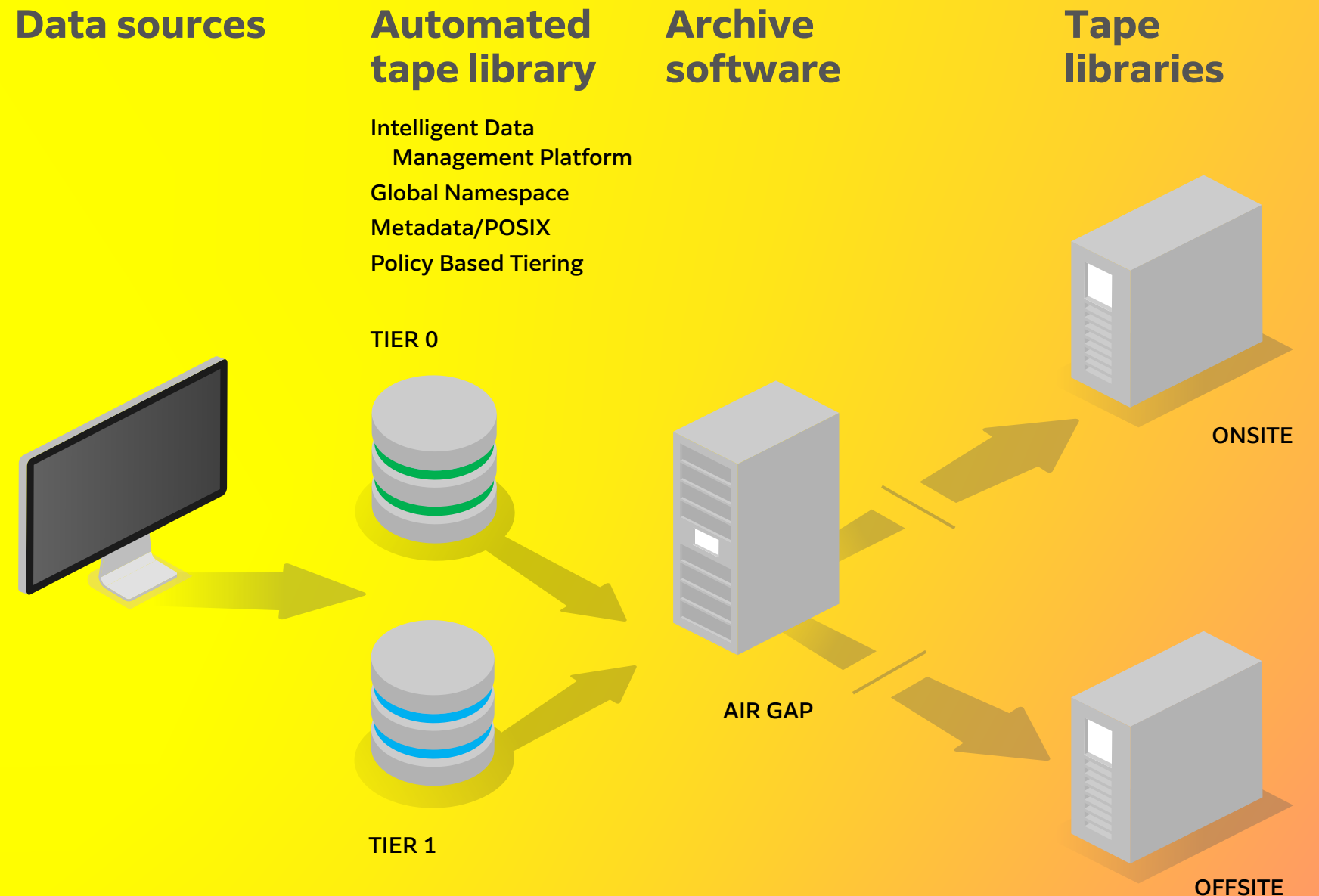**Archive software**

Tape libraries

ONSITE

AIR GAP

TIER 1

OFFSITE

03

Use case:
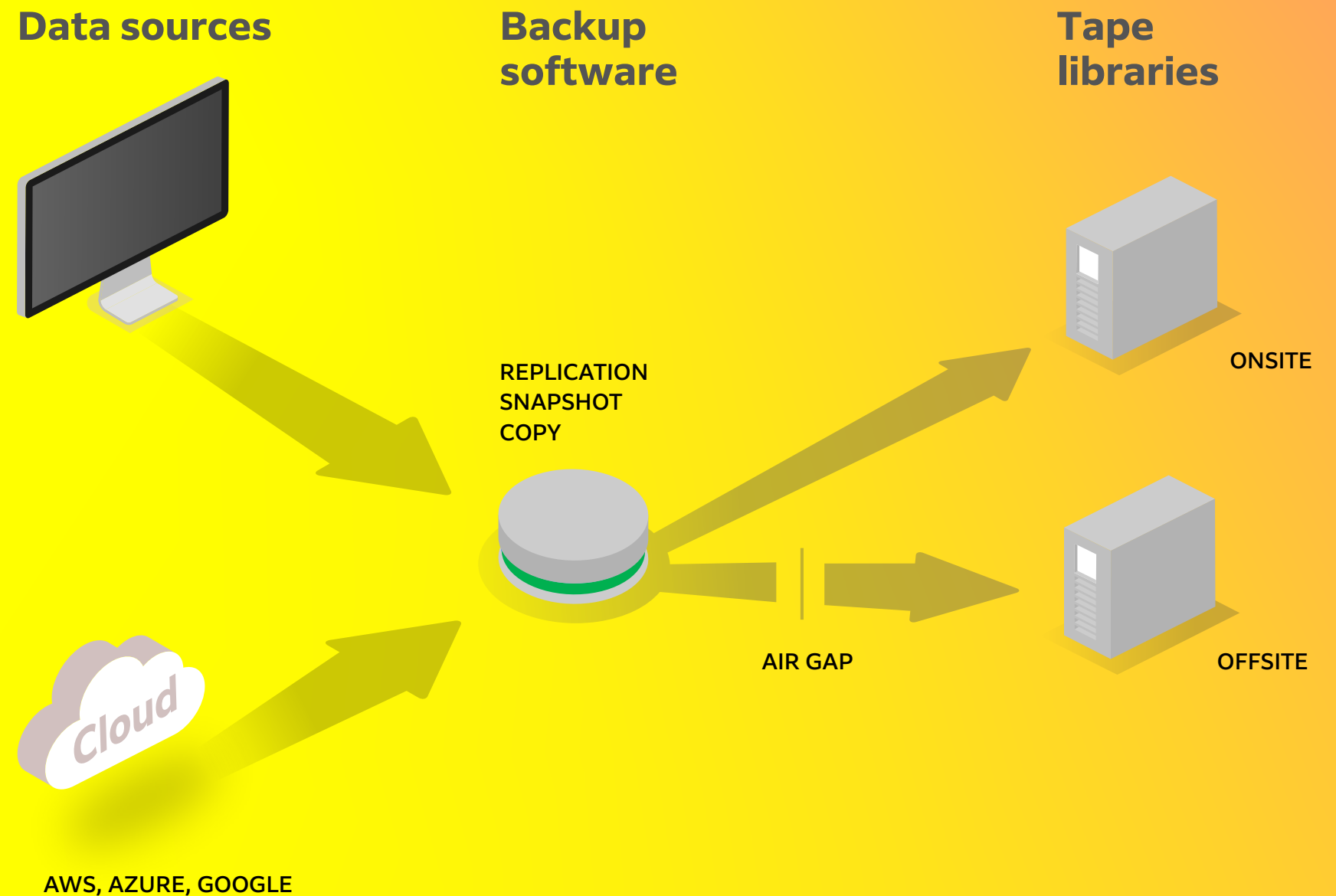## Data protection
and recovery

Storage to replicate data and protect from loss or thefts

Data protection and recovery involves replicating data or creating a snapshot that is then transferred to tape.

By being written to tape media in the tape library, the data is protected; this copy can be a replicated copy, data snapshot or a copy of cloud data. It can be stored onsite to safeguard against the local loss of data, and/or offsite for disaster recovery.

Data protection and recovery ensures businesses are covered in the event of data loss due to ransomware, natural disasters or cloud outages.

Data sources

Backup software

Tape libraries

REPLICATION
SNAPSHOT
COPY

ONSITE

AIR GAP

OFFSITE

Cloud

AWS, AZURE, GOOGLE

04 Tape technology for better performance

04

Innovation

The tape industry has made tremendous strides in capacity and throughput since its inception. Tape media capacity has increased 10 million times while the data rate has increased 53,333 times.

Take LTO for example: originally introduced in 2000 at 100 GB and 20 MB/sec transfer rate. Compare that with today's generation 9, with 18,000 GB and 400 MB/sec — that's a whopping 180X increase in capacity and 20X increase in performance!

Fujifilm is committed to continuously building on innovation. Plus, we rigorously test our products in extreme environments to ensure quality and cost efficiency remains consistently high with each new generation.

Encryption

Modern tape natively supports AES256 based encryption for an even higher level of data security.

WORM

(Write-Once-Read-Many)
Beginning with LTO-3, Write Once Read Many (WORM) functionality provides for non-erasable, non-rewritable operation with tape media and is designed for long-term tamper resistant record retention.

[2] www.asset.fujifilm.com

04

Technologies to achieve higher capacity

The last 70 years have seen dramatic innovations in tape development—tape is evolving with the times. New technologies have been implemented and expanded on for the purpose of increasing storage capacity and improving performance.

FEATURES THAT CONTRIBUTE TO HIGH DENSITY

Tape thickness
Reducing overall tape thickness enables more tape to be wound in a single cartridge, leading to higher recording area. As a result, customers who use the LTO-9 unlock even more storage capacity as there is more surface area on which data can be saved.

LTO-6:
- Thickness: 6.4μm
- Length: 846m

LTO-9:
- **Thickness: 5.2μm**
- **Length: 1035m**

04

Nano-coating technology

Nano-coating technology can be compared to spreading one liter of water onto 4 football fields evenly. Fujifilm's Nanocubic technology combines nano-scale particles with a unique coating process and advanced dispersion techniques, to achieve an ultra-thin magnetic layer that produces higher resolution for recording digital data.
For tape, this results in a much higher storage capacity, enabling customers to maximize on their investment.

Fine magnetic particles

Smoother magnetic tape surface allows the drive head to get closer to the tape surface, allowing higher detection accuracy and output performance. In real-life terms, this means that even with even smaller particles, better performance is achieved.

Track density

Thousands of tracks run on tape for data recording —increasing the number of tracks contributes to capacity improvement. For example, the latest LTO-9 has 8960 tracks on tape, meaning that more data can be stored at a higher density.

05 Why Fujifilm

05

Fujifilm tape

As the capacity roadmap demonstrates, Generation 14 of the LTO product line will allow for 576TB of storage by the 2030s.

LTO Ultrium Roadmap

Addressing your storage needs

	Native	Compressed
Gen14	Up to **576TB**	Up to **1,440TB**
Gen13	Up to **288TB**	Up to **720TB**
Gen12	Up to **144TB**	Up to **360TB**
Gen11	Up to **72TB**	Up to **180TB**
Gen10	Up to **36TB**	Up to **90TB**
Gen9	18TB	45TB
Gen8	12TB	30TB
Gen7	6TB	15TB
Gen6	2.5TB	6.25TB

Partitioning Enabled LTFS | **Encryption** | **WORM**

05

Fujifilm tape

Our goal is to help clients realize the full potential of archival storage, by extending our reach beyond just storage and into sustainability.

Tape is playing an important role in trimming the environmental impact of data storage. We know that moving 60% of global HDD resident data to tape could reduce global carbon emissions by 72 million tons.[3] And this is just the start—which is why we're innovating not only our tape technology, but also our packaging and production solutions.

Our Sustainable Value Plan 2030 outlines our goals to realize sustainable procurement – considering both the environment and human rights—as well as our aims to secure greater compliance with biodiversity legislation.

Fujifilm is at the forefront of innovating the next wave of smart, sustainable data management solutions. We are the world's largest manufacturer of tape, and since we're based in the US, our clients can rely on us to bring them better, quicker and simpler access to service.

We provide the right solutions to help businesses achieve financial business objectives, growing capacity demands and enhanced sustainability targets.

[3] www.datastorage-na.fujifilm.com

05

Let's talk about it

Fujifilm enables organizations to cost-effectively manage data growth with innovative products and solutions. We are developing the next generation of secure and sustainable data management solutions that are right for your business.

If you're interested in finding out more about tape storage for archival, data protection and recovery, get in touch with **Jennifer Harris** on **jennifer.harris@fujifilm.com** or **(512) 819-1637**.

Or if you just want to know a little more about our LTO-9 Tape, **click here** for more information.

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