

ACTIFIO COPY DATA VIRTUALIZATION

# How It Works

*An exploration of Actifio technology, purpose-built to combat the copy data problem found at the core of the enterprise storage explosion*

actifio  
Radically Simple

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# How It Works

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## Introduction

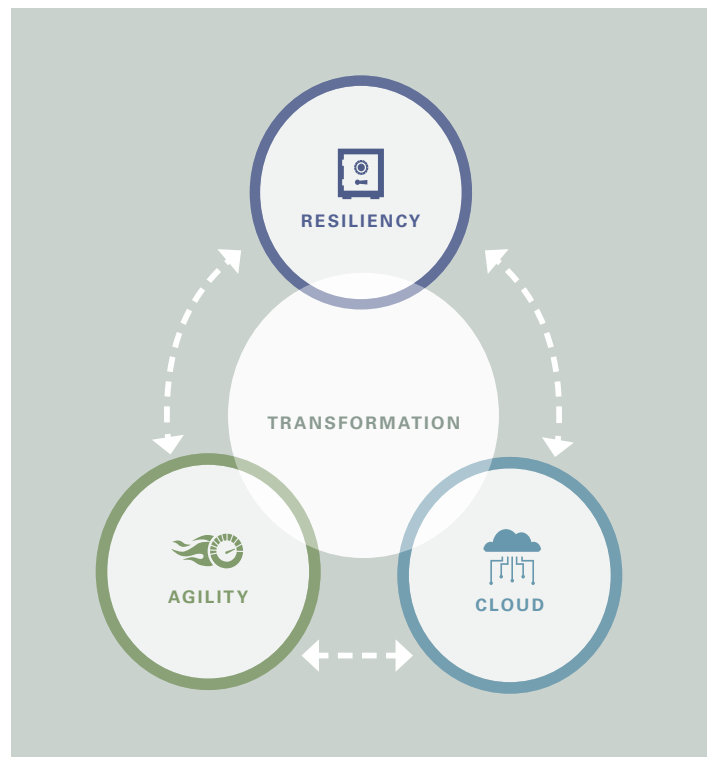
Data storage technology is undergoing a number of fundamental enhancements. For example, primary data storage is moving from HDD to SSD/Flash technology. Protected storage continually gets more economical with new data efficiency technologies such as compression and deduplication. Additionally, virtualization and cloud implementations are driving storage arrays to do more, taking on new personalities in order to service new customer requirements and growing business demands. Despite these advances, the basic approach to the way data is managed within the enterprise hasn't changed in more than two decades.

This document is intended to provide a detailed understanding of Actifio's advanced technology and how it is changing the data management paradigm. This document explains how Actifio's innovative approach to data management enables IT professionals to stay ahead of the data explosion that is driving increasing IT costs. Actifio's Virtual Data Pipeline™ (VDP) technology provides customers with a revolutionary data management solution. Actifio understands that customers are looking for better ways to protect and leverage their data while reducing costs and complexity. Actifio supports these business objectives by providing greater resiliency, business agility, and cloud mobility. The Actifio VDP platform lets customers have ultimate control over their data management objectives for today's as well as tomorrow's business needs.

## Virtualization—The Foundation

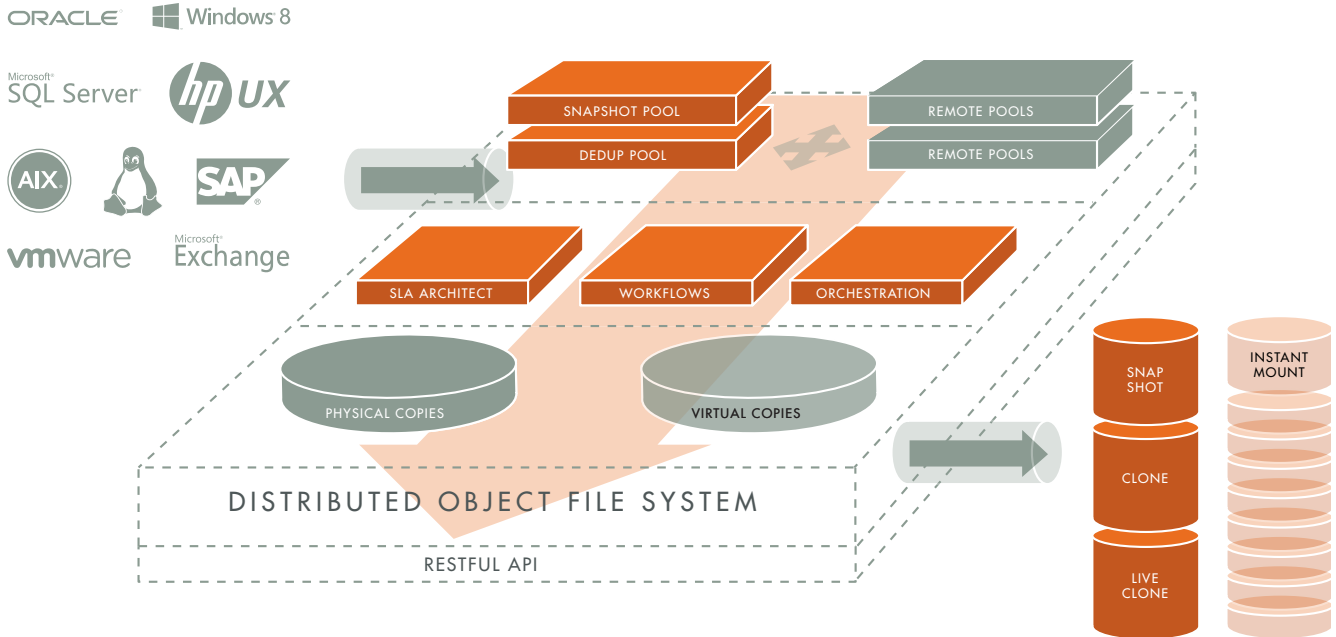
Virtualization sits at the core of the IT evolution and is the foundation for Actifio's Virtual Data Pipeline (VDP) technology. Information technologists have seen the value that virtualization has already brought to other layers within the data center. Server virtualization provided the ability to reduce the overall physical infrastructure, develop a more standard server configuration, allow workloads to move easily, and increase operational efficiency. Storage virtualization has allowed IT organizations to gain better utilization of their overall storage environment, reduce storage sprawl, enable common storage services across their storage and not be beholden to any one storage vendor. Server and storage virtualization have been helping IT organizations save millions of dollars in their overall IT budgets for the last decade.

FIGURE 1: Data Management Transformation – Resiliency, Agility, Cloud



On the horizon is to move beyond infrastructure to the application and data layers. Data virtualization provides IT the ability to create unlimited virtual copies of data for multiple purposes from a single gold copy, eliminating the need to have multiple physical copies of data. This allows IT organizations to streamline a number of business operations including backup and recovery, test and development, business continuity, disaster recovery, and analytics. The Actifio platform is the first technology to provide users with virtualized data that dramatically reduces storage usage and growth rates, consolidates multiple point technologies, reduces operational complexity, and allows IT to exceed all of their data SLAs. Above all, the platform does so without an impact on production systems.

FIGURE 2: Actifio's Virtual Data Pipeline™ Architecture



*If you're dealing with a storage explosion inside your enterprise, data copies created by data storage services are likely to blame for it.*

### The Current Data Management Approach

The traditional data management approach has been compartmentalized, depending on various business requirements resulting in multiple silos of duplicate data. Across applications, there are multiple data services such as mirroring, cloning, replication, thin provisioning, and snapshot technology, as well as data efficiency services such as de-duplication and compression. The challenge is that these data services drive tremendous amounts of redundant data copies that utilize valuable storage capacity and a tremendous amount of storage and data management resources. A radically different approach is required in order to solve the data copy explosion problem. Using customary tools with the same processes will not allow IT organizations to get ahead of data explosion.

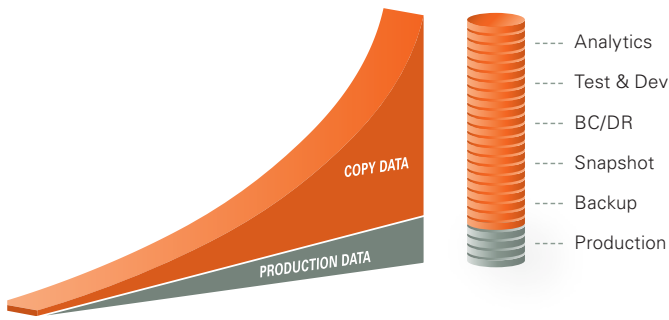
### Copies of Production Data Drive Data Growth

IDC estimated that unnecessary storage capacity of multiple copies of data cost businesses roughly \$44 billion in 2013. In a May 2013 study, IDC also estimated that in 2012, more than 60% of enterprise disk storage systems (DSS) capacity was made up of copies of data. This

explosion of data is due to the practice of creating separate copies of production data in order to protect and run the business. Backup, disaster recovery, test & development, and data analytics are all business operations that compound the copy data growth problem. The vast majority of IT shops deploy separate tools to perform each of the same basic four operations; *copy*, *store*, *move* and *optimize* data. The result is a range of 13 to 120 duplicate copies of data that costs the business up to 5 times more for additional infrastructure and management than the production data. **Figure 3** shows that even with data optimization services, IT can save some storage space but are still managing the same number of data copies.

Most companies try to leverage these copies of data in order to increase the performance and accessibility of production data. However, copying data throughout the infrastructure eats up valuable storage space and actually slows business responsiveness. Actifio's objective is to eliminate the copy data sprawl and allow organizations to deliver better performance and availability of their data. Actifio's copy data virtualization technology is the underpinning of that simplification.

FIGURE 3: The Copy Data Growth Challenge



- Copy data a \$44B problem
- Consumes 60% of primary disk capacity
- Drives 65% of storage software spending, 85% of hardware

FIGURE 4: Next Generation Data Management—Capture, Manage, Use



## Actifio Technology—Radically Simple Copy Data Virtualization

Today, IT is looking for three specific capabilities. First, application—not infrastructure—centricity. Data management functions need to move as close to the application as possible. Second, IT wants to ensure data is stored as efficiently as possible. This means leveraging data efficiency services such as deduplication and compression, but also storing only the data that is needed to enable an efficient, agile business. And finally, IT wants the ability to use their data, when they need it, in a way that drives business operations efficiently.

Actifio’s copy data virtualization platform consolidates disparate storage service applications (such as backup, recovery, replication and deduplication), and provides a data management platform that allows IT to deliver true application-centric data services. Actifio has liberated IT organizations and service providers of all sizes from data service sprawl, as well as the management challenges associated with the explosion of data copies. Actifio does this with three simple principles as shown in **Figure 4: Capture, Manage, and Use.**

### Actifio—Data Virtualization, A Radically New Approach

At the heart of the Actifio copy data virtualization platform is Actifio Virtual Data Pipeline™ (VDP). Actifio VDP virtualizes your data, allowing IT to provide data protection, test & development, analytics, as well as disaster recovery and business continuity all through a single storage platform, from only one golden copy of your production data. Actifio allows IT to access a single, any point-in-time copy of your primary data, through a mount, clone, live clone or restore operation; this is why Actifio is Radically Simple.

### Copy Data Virtualization In Action

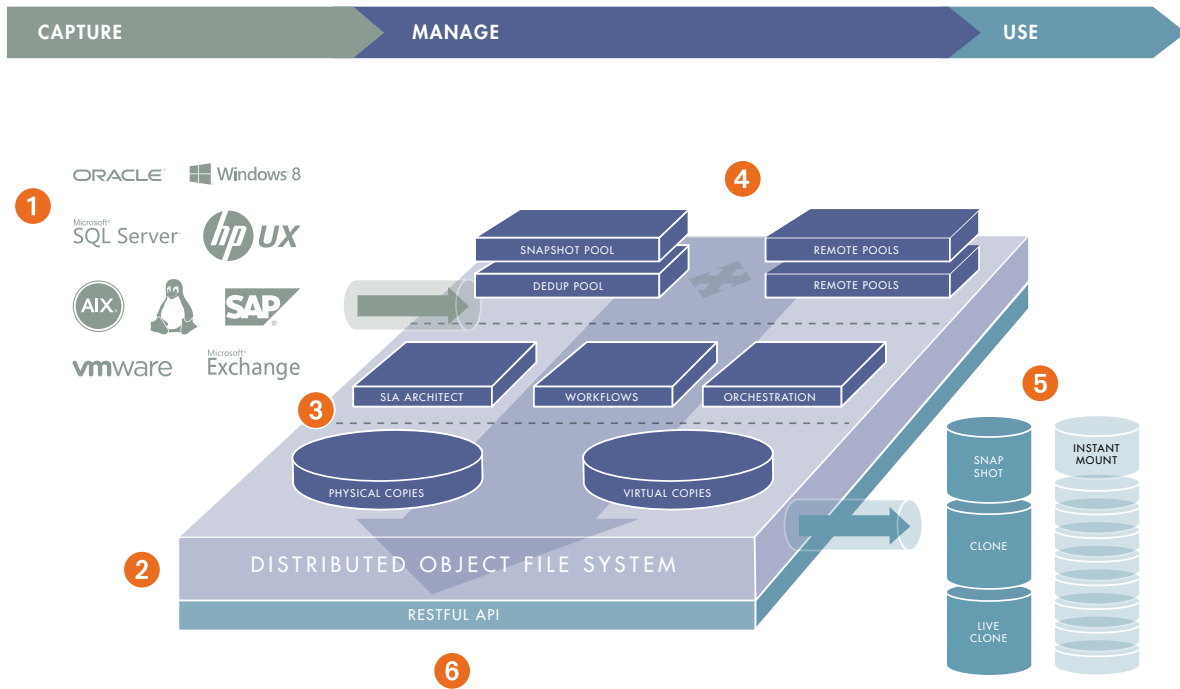
Actifio’s platform can be deployed either within the SAN Fabric or “out-of-band,” over the network. Actifio can leverage existing storage in the environment, or be deployed with integrated storage. Each method has its advantages, is not mutually exclusive, providing flexibility in deployment and ongoing management.

Actifio Virtual Data Pipeline technology can run as a fully integrated physical or virtual appliance. Its function is to virtualize your data by consolidating copy services in the environment and allowing IT organizations to use a single golden copy of the data for multiple business solutions. Applications are able to directly access a virtualized copy of the data through the Actifio appliance without any data movement. This is important, as data movement adds time, expense, and business impact.

### New Rules of Data Management—SLA Driven

Once Actifio is deployed in the enterprise, two things happen to drive operational efficiency. First, Actifio discovers applications and/or file systems running in the environment. The second step, applies service level agreements (SLAs) to applications and data sets. Actifio binds the data management services such as snapshots, replication, workflows, lifecycle management, and deduplication directly to the application,

FIGURE 5: Actifio Virtual Data Pipeline—VDP



enabling the appropriate SLAs from the volume level down to even the individual VM level. This allows you to ensure the appropriate lifecycle policies for each unique application.

Creating an SLA is simple and intuitive. They define the frequency of capture, lifecycle policies, retention periods, data mobility type and frequency, and more. Workflows leverage the point-in-time data sets created by SLAs to add additional levels of automation.

Each of these SLA's can be applied individually to each application or data set, based on the value of the data, giving IT more control over how data is leveraged in the environment. SLAs are the cornerstone to the next generation of data management.

## How Data Virtualization Works

Actifio instantly captures application-consistent copies of data, in its native format, utilizing Changed Block Tracking (CBT) technology based on SLAs that have been defined. This technology is the industry's fastest, most efficient, and scalable method of data capture.

### Discovery 1

In order to ease management, Actifio discovers hosts, applications, volumes and file systems. **Figure 5, section 1** shows a few of the operating systems and applications that Actifio can auto discover and capture. Actifio supports virtual hosts as well as physical hosts. Auto discovery can occur in multiple ways, depending on the

user environment, leveraging industry-standard technologies such as: VMware vStorage API's™, Oracle RMAN™, Microsoft VSS™, as well as lightweight Actifio Connectors.

### VMWARE™ VSTORAGE APIS

Actifio leverages VMware snapshots and a feature of VMware's vStorage APIs for Data Protection called Changed Block Tracking™ (CBT). VMware specific environments are discovered by querying VMware vCenter for a list of ESX servers and the VM's running on those servers. This enables Actifio to capture changes from the production environment non-disruptively. Changed Block Tracking allows Actifio VDP to copy and transport only the blocks that have changed since the last data collection on to the Actifio system making data collection fast and efficient.

Actifio is fully integrated with VMware vSphere™, beginning with version 4.0. Actifio communicates directly with the VMware vCenter management server and initiates the data collection process by taking a VMware snapshot of the Virtual Machine. VMware VM snapshots provide Actifio with an application consistent view of the blocks on the virtual disk(s) inside of a VM.

### APPLICATION APIS (PHYSICAL ENVIRONMENTS)

Several enterprise class applications and platforms provide advanced interfaces for better manageability of copy data services. Examples include Microsoft Windows VSS, Oracle RMAN and Backint SAP APIs (please see application specific white papers for greater detail). on how

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*Actifio provides the flexibility for you to choose the storage for your virtualized data allowing you to repurpose storage and lower costs.*

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## Copy Data Virtualization

In order to drive true change, Actifio set out to disrupt traditional rules of data management. There are **five key rules** when it comes to data virtualization.

**The First Rule:** *Consolidate overlapping storage services* by performing the basic functions of: copy, store, move, and optimize for all applications using a common data management platform. That means less software to support, fewer licenses to buy, fewer integration headaches and the elimination of operational complexity.

**The Second Rule:** Don't capture, store, or move something again if you already have it.

**The Third Rule:** Provide data efficiency services such as *global de-duplication and compression* of all your data copies. This results in less data to move across your network, less data to store wherever you want it stored, greater efficiency for long-term retention, and reduced TCO.

**The Fourth Rule:** Design a solution that's *application centric* enabling different SLA's for each application. Actifio makes it economically feasible to have time slices of data for each application, enabling users to mount, clone, live clone or restore data, from any point in time. This allows IT to make data instantly available, anytime.

**The Final and Most Important Rule:** Make the solution *radically simple* to deploy, manage and integrate into the infrastructure to lower operational costs, improve SLAs like RPO/RTO (Recovery Point Objective/Recovery Time Objective) and solve the data management challenges caused by redundant copies of data.

### 5 Golden Rules of Data Virtualization

1. Consolidate overlapping storage services
2. Don't store the same data twice
3. Provide global deduplication and compression
4. Ensure application centricity
5. Make it Radically Simple to deploy, manage, and integrate

Actifio VDP provides copy data virtualization to specific applications). Actifio VDP integrated directly with these API's to capture an application-consistent snapshot of the data and import only the changed blocks into Actifio (for a complete list of supported interface, please see website). This provides the most efficient and accurate level of data capture to insure application consistency when mounting, cloning or recovering the application data.

### ACTIFIO CONNECTORS

Actifio leverages connectors for physical servers in order to obtain application consistency during the precise moment a snapshot is taken. The Actifio connector installs on a server non-disruptively and is a lightweight, low I/O profile service, used to provide tighter integration with various applications and to report changed blocks to VDP.

Actifio Connectors are also used to include file systems mounted on servers that have DAS, SAN or NAS devices as storage. This means that both file and block copy data services on those servers can now take advantage of Actifio's data virtualization. Actifio connectors are centrally managed making for simple deployment and management and facilitate communication from the host to Actifio VDP.

For applications and operating systems that are homegrown or do not have built-in interfaces for quiescing, Actifio's internal snapshot technology can quickly capture crash consistent views of the applications data. In addition pre- and post-snapshot scripts can be run to ensure data consistency.

### Data Capture—Virtualizing the Application Data

Once the application or server is discovered VDP creates an initial data set. A snapshot is taken, and this snapshot is copied to Actifio VDP. Actifio VDP mounts a staging disk to the host and a data copy takes place to create this first data set. Actifio leverages advanced Copy On Write (COW) snapshot technology for physical server environments such as Microsoft Windows™, Unix, Linux, and IBM i Servers™ (for a detailed list of supported operating environments and application, please see [www.actifio.com/support\\_matrix](http://www.actifio.com/support_matrix)). The next step takes place based on the SLA assigned to the data set to address incremental changes. The staging disk is remounted to host and a snap copy is taken to capture the updated data. Based on the defined SLA, a point-in-time copy of the data set is now available for use. The snapshots taken build into synthetic full snapshots allowing a IT to mount, clone, live clone or restore any snapshot from any point in time from Actifio's virtualized data pool.

## Manage—Optimized Lifecycle Management

### Distributed Object File System 2

Once the data is captured, it lands in Actifio's Distributed Object File System. **Figure 5, section 2** represents Actifio's Distributed Object File system on which the Actifio data services live. By consolidating the silos of data management services, managing the data becomes simple, consistent, efficient, and removes business risk.

### Virtualizing the Storage Repository 3

Through storage virtualization, Actifio enables customers to leverage any storage device providing better storage utilization and further reducing the storage footprint. **Figure 5, section 3** represents the data services that Actifio provides on the virtualized storage repository. IT organizations can now have their SLA's dictate the type and tier of storage they use, rather than be constrained by any individual storage vendor. With the power of the Actifio system, many users have re-purposed existing storage for their virtualized copy data or have opted for lower cost storage devices based on application SLA requirements. This capability further allows for better storage utilization while lowering the overall storage costs.

#### GLOBALLY DE-DUPLICATING AND COMPRESSING CHANGED DATA

When data is stored for backup or long term retention, all changed blocks captured by Actifio VDP are globally de-duplicated, ensuring that the same 4K blocks are never unnecessarily stored or moved again. Compression further enhances the storage efficiency. Global deduplication and compression provide the following benefits:

- Globally de-duplicated and compressed data can be economically stored on disk for long periods of time for long-term data retention
- The de-duplicated data pool provides a second, fully independent copy of the data for protection against physical problems with the production storage environment
- Deduplication and compression optimizes the data set for transport between sites eliminating the need for additional WAN optimization hardware

### Service Level Agreements—SLAs 4

Data is captured and stored in the distributed object file system based on the SLAs determined by the systems administrator that align to the needs of the application. **Figure 5, section 4** is the engine where SLAs are set and applied to the primary data services. SLA's are developed generically based on service catalog requirements, then applied for each application based on its value to the business, defined by variables such as capture frequency and retention periods. For example, a Tier 1 application may have a snapshot taken every 4 hours to enable a more granular RPO. Additionally, workflows can be introduced that allow virtual data sets, to be mounted or cloned on a schedule so test and development teams can work with the latest data sets.

## Use—Data Availability

### Virtualizing the Data Availability Operations 5

Once the data is in the Actifio virtualized data repository, using this data is simple and easy. The Actifio platform delivers the unique capability of enabling applications to directly use point-in-time data copies, without the need for a traditional "restore" operation. This is because Actifio acts as an intelligent, fully integrated storage solution that can instantly create a virtual copy of the application data from any available point in time, and allow applications to access it efficiently via a Fibre Channel or iSCSI interface, just as if accessing a traditional storage system.

**Figure 5 section 5** visually shows the different virtual data copy capabilities.

Application data from any point-in-time copy can be accessed from any permitted system connected to the Actifio copy data storage solution. Common use cases are to:

- Mount a volume to be used for test or development purposes
- Recover data or a complete VM after a software or system failure
- Retrieve a file that was deleted accidentally
- Use a virtual copy of a production data set for testing, development, or analytics

There are four different methods than can be used to access the data stored on Actifio copy data storage: *Mount*, *Clone*, *Live Clone* and *Restore*.

#### MOUNT

The mount function is the most frequently used data access method by Actifio customers, as it directly leverages the virtual copies of data managed by Actifio. Actifio VDP stores a copy of the production data and tracks the changes over time. Since VDP already has the data and can service IO directly, there is no need to copy the data anywhere for use. Virtual copies of the data can be mounted instantly on any system in the environment using efficient block-level iSCSI and Fibre Channel protocol. By eliminating the data movement from the process, data sets of any size can be accessed instantly on any server in the environment, virtual or physical.

#### CLONE

The clone function is used to create an independent copy of a data set for any number of reasons. The most common uses are: application development and testing, data audit for compliance, data warehousing, e-discovery, and user acceptance testing. Virtual server or physical server application consistent data sets can be copied from any point in the system to a separate storage location anywhere in the environment.



## LIVECLONE

The LiveClone function is used in a similar fashion to the clone function however, when a refreshed copy of the data needs to be available, live clone allows an independent copy of a data set to be mounted, but then allows a fresh copy of the data to be maintained as the data in the primary data is refreshed. This allows teams such as test and development a way to automate the process of ensuring they are working on the latest set of data without requiring a lot of data management.

## RESTORE

The restore function will effectively revert the production data to look exactly as it did at the time of the data collection point. This function is the only operation that moves 100% of the data before it can be used. Typical use cases for restore would be to recover an entire server or application to a valid state after a massive data corruption or storage array failure. It is important to remember, that this takes the most time from a “recovery” perspective.

## RESTful API Extensions 6

Actifio also provide programmatic extensions of VDP through open standards and a RESTful API that can accelerate time to value for administrators that want to report through their own portal, ISV's or even MSP's creating their own set of services.

## File Level Recovery

While all datasets can be accessed very quickly at the VM level or at the volume level, Actifio provides a file level recovery feature for Windows systems. File level recovery allows the administrator to browse the data set directly from the Actifio GUI to retrieve individual files or directories from any NTFS volumes that are managed by Actifio.

## Object Level Recovery

Actifio also provides object level recovery for Microsoft SharePoint™ and Exchange™ systems. Individual objects can be retrieved or restored back to production from within the application content database including emails, documents, mailboxes, contacts, etc. Actifio can help to manage consistency groups allowing customers to recover data sets that mixed.

FIGURE 6: Copy Data Virtualization Saves on Space and Number of Copies

### Relative Size of Capacity Utilization

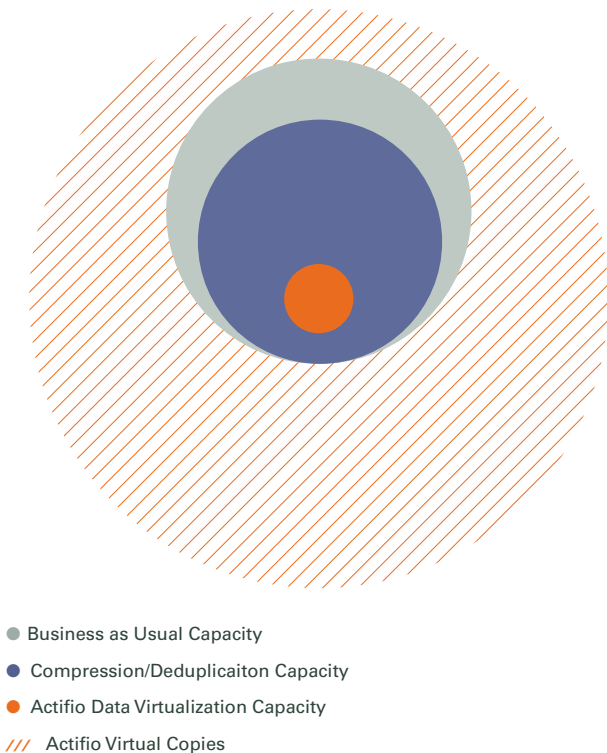
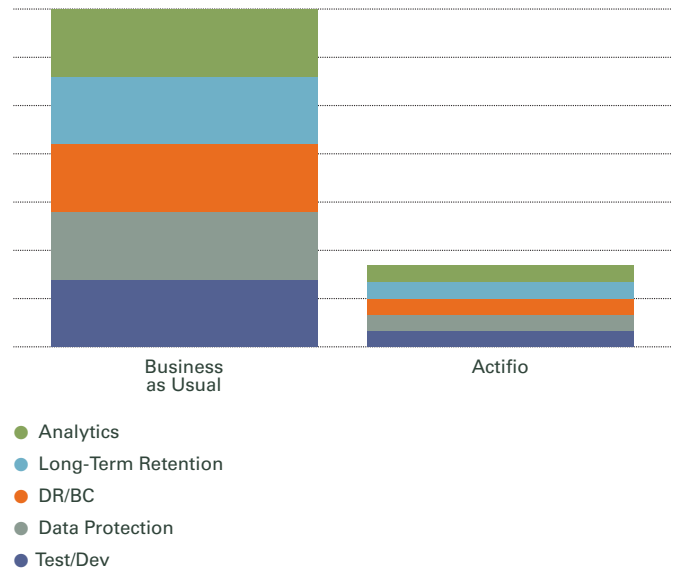


FIGURE 7: Actifio Lowers Risk and Maximizes Value Over Time with Multiple Use Cases

### Cost, Complexity, and Capacity Utilization



## Bare Metal Recovery

Actifio provides Bare Metal Recovery (BMR) optionally to deliver protection of physical system state of Windows and Linux machines, in order to get servers quickly back up and running in event of failure. BMR provides the ability to protect and restore both physical system state and data based on SLA, restoring to either similar or dissimilar hardware..

## Tape

Actifio provides IT with the ability to ensure data is stored properly on the most cost effective storage medium available that also meets business requirements. As data ages and becomes “stale” or not used often, putting data onto tape may help business to meet their data retention requirements the most economically way possible. Actifio can migrate volumes of data off to tape, based on policy to help meet retention and economic requirements.

## Virtualizing the Data Move Operation

Moving data in any IT environment is very time consuming and expensive. Actifio understands this and delivers the industry’s most robust, secure, and scalable data mobility capability that not only drives down the overall network usage, but also eliminates the need for

dedicated WAN acceleration devices. To support data movement outside of the datacenter or remote office, Actifio offers four types of replication: Synchronous, Asynchronous, Dedup Async, and Dedup Backup replications. Primarily for DR and BC purposes, Actifio’s technology efficiency creates remote copies of application data that are available for instant recovery operations. Data move operations are incorporated into the SLAs defined and applied to the data set. Actifio Sync and Async are similar to the synchronous and asynchronous replication offered by traditional storage arrays, although completely vendor agnostic. Both utilize a Fibre Channel connection between customer sites for efficient data movement. Dedup Async replication is a patented, extremely efficient method of replicating point-in-time changes to a remote location using any standard WAN link without the need for a WAN acceleration device. Dedup Backup replication is used for backup purposes to store remote copies of data for long-term retention. All methods described use secure, encrypted communication in data replication.

Actifio data replication does not require storage array vendor licenses, as data is sent from one Actifio system to another. Replication is heterogeneous, from any supported array to any supported array (Tier 1 to Tier 2 and/or Vendor A to Vendor B,) and is fully integrated with VMware vCenter Site Recovery Manager™.

## Flexible Data Mobility

**Sync Replication** Synchronous replication for real-time data mirroring uses a fibre channel connection between locations and can be guaranteed between customer sites up to 300KM apart.

**Async Replication** Asynchronous replication, also used for mirroring to a remote site has no distance limitation and will send data over the WAN as fast as network bandwidth allows.

**Dedup Async™ Replication** Dedup Async, is an industry first that is uniquely delivered by Actifio. Dedup Async replication is the industry’s most efficient way of moving data to a remote site, and customers have seen bandwidth savings by as much as 10X. Dedup Async replication provides asynchronous data replication that uses deduplicated and compressed data movement over the network. This approach uses a fraction of the bandwidth required

with traditional replication technologies. When using Dedup Async replication, when the data reaches the remote site, the data rehydrates based on the SLA defined for the given data set. This provides customers the ability to instantly access the data in the remote location. Dedup Async enables disaster recovery protection for a much broader set of applications where traditional storage replication technologies are cost-prohibitive.

**Dedup Backup Replication** Customers who want to keep data off-site for long-term retention or application retirement purposes can leverage Actifio’s deduplication- aware replication protocol. This replication method enables the transmission of only the globally unique blocks that are needed in the remote Actifio system, ensuring the most efficient data movement possible. When data is required, the user can pick a point in time

from which to rehydrate the data, and make that data available.

Furthermore, the Dedup Backup replication and Dedup Async replication services utilize the same data stream for even more efficiencies. With traditional technologies, a customer will require bandwidth for primary storage replication as well as backup replication. With Actifio, these two services share the same bandwidth as well as data blocks. For example, when the primary storage blocks are replicated by Dedup-Async replication, those blocks do not need to be present when Dedup Backup replication starts some time later, since those blocks are already at the DR site. The end result is data can be replicated in multiple ways, the same globally deduplicated and compressed data stream, saving significant time and money.

## Automated Disaster Recovery

When deployed in a VMware vSphere environment, Actifio has the ability to automate the scheduled and on-demand execution of recovery plans - for recovery testing as well as actual failover. Plans can be structured to recover whole vApps or individual VMs in Application Groups.

## Economic Impact

Actifio's Copy Data Virtualization is the industry's new approach to data management. The first main step in changing the paradigm in how data is managed is to gain control over the data sprawl. The key to stopping the data sprawl is by consolidating all of the data services that are managed in multiple data silos today. Traditionally snaps, backup, replication, archive as well as data efficiency services such as compression and deduplication are done differently, with different technologies on different storage arrays which is very expensive. The Actifio VDP platform delivers a common set of data services reducing the costs required to manage your data as well as reducing all of the costs associated with multiple software licenses to support multiple storage arrays. Actifio includes all of the data service features that are normally purchased as separate software licenses. Additionally, Actifio cuts down on data sprawl in the environment so less capacity is required. And finally, because IT is using dramatically less capacity, they are also saving on power/cooling and floorspace.

Actifio's impact is transformational, and yet getting started is easy. Actifio can be implemented over time for a number of different use

cases. As an example, Actifio could be deployed to provide virtual data access, versus making additional copies of the data, to the test and development groups to provide them access to the latest data set at the lowest possible cost.

Over time, as IT sees the capabilities of Actifio, and understands the value, Actifio can then be leveraged to take on more use cases such as data protection, DR/BC, or long-term data retention. This ensures that IT is not introducing risk into the environment but rather methodically planning the evolution of new data management practices.

Just as VMware redefined the approach to compute, Actifio is redefining how businesses capture, manage, and use their data for greater resiliency, agility, and cloud mobility.

## About Actifio

Actifio delivers copy data virtualization to hundreds of global enterprise customers and service provider partners in more than 30 countries around the world. Our Virtual Data Pipeline™ technology decouples data from infrastructure, enabling dramatic improvements in business resiliency, agility, and access to the cloud. Actifio replaces siloed data management applications with a radically simple, application-centric, SLA-driven approach that lets customers capture data from production applications, manage it more economically, and use it when and where they need to. Actifio is headquartered just outside Boston, Massachusetts, and can be reached via the web ([actifio.com](http://actifio.com)), Twitter ([@actifio](https://twitter.com/actifio)), or email at [info@actifio.com](mailto:info@actifio.com)