

# 4 Secrets MSP Need to know about Cloud Storage

The New Economics of Cloud Storage:  
How Bifrost Cloud Storage Helps MSPs  
Save on Storage Costs for Clients



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# Who is Bifrost Storage Cloud?

Bifrost Storage Cloud is your next-generation cloud storage solution, utilizing a Distributed Architecture storage model to create resiliency, safety, and security for your data.



## Introduction

Cost factors into our decision-making process every day of our lives. We are constantly making choices with cost in mind, whether we are at the gas pump, the grocery store, financing a home or looking for a cloud storage provider. In the world we live in, everything has a cost. And in business, affordability can mean the difference between getting the services your company needs and going without. While cost is not the only factor in choosing a cloud storage provider, we know that it can have a huge impact on a company's bottom line as well as the quality and scope of services available to a business. Data loss can have a serious impact on business operations or even result in business closure, so choosing the right provider for data storage is critical to any company, especially businesses that rely on secure data storage and high data accessibility to provide services of their own.

With cost top of mind, we also know that companies are always looking to find ways to lower overhead expenses while maintaining quality services. Our clients have experienced an average of 90% cost savings

by switching from traditional cloud storage to Bifrost Storage Cloud while gaining a 99.9999999999999999% guarantee, otherwise known in The Rule of Nines as "Twenty Nines"<sup>1</sup>, that your data will not be lost or corrupted while in partnership with us. Let us introduce you to the new economic model for cloud storage solutions.

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<sup>1</sup> The Rule of Nines is a metric by which technologists measure the amount of downtime a system might experience. The higher the number of nines, the smaller the amount of downtime, and the higher the availability of the network. The higher the availability of the network, the smaller the likelihood of data loss. The industry standard for Uptime is "Five Nines," which calculates to 864 milliseconds of downtime per day or 5.62 minutes of total downtime in a year. At "Twenty Nines," data stored with Bifrost Storage Cloud is guaranteeing weekly downtime of 0.6 milliseconds and total downtime in a year of 0.031 seconds. Sources: Wikipedia Page on [High Availability](#); SLA calculations for "Twenty Nines" at [www.uptime.is](http://www.uptime.is).



# 1

## The Problems with Pricing in the Cloud Storage Marketplace

The cloud storage industry is growing rapidly, as more and more companies discover the benefits of storing their data with cloud technology. **Fortune Business Insights** predicts that the cloud storage market will be worth \$376.37 billion by 2029, with a compound annual growth rate of 24% over the next seven years. Despite the growing need for cloud storage and the benefits of storing data in the cloud, the cloud storage industry has a problem when it comes to pricing services at a rate that the average company can afford.

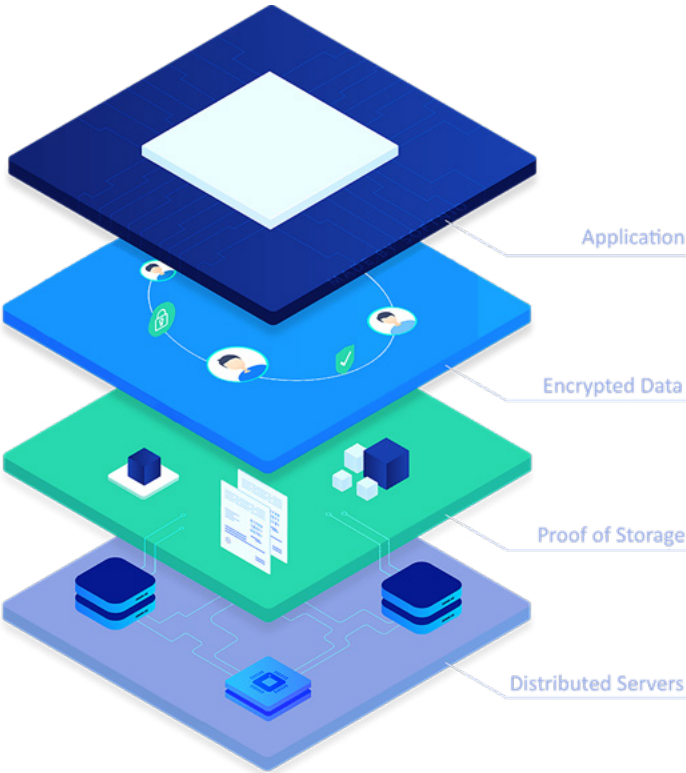
Why? Because owning and maintaining data centers is an extremely costly endeavor. A cloud storage company operating within a traditional cloud storage model needs to lease or own property, lease or own servers and maintain those servers. There are additional costs to consider, including but not limited to maintaining a temperature-controlled environment, staffing, and security for the server system. Building an enterprise data storage center from the ground up can cost anywhere between \$500 million to \$2.5

billion<sup>2</sup> and the annual cost of maintaining a data center in one geographic location once it has been built ranges between \$10 million and \$25 million per year<sup>3</sup>. In the traditional economic structure of cloud storage solutions, the cost of building and maintaining these data centers is often passed from the storage provider to the client, ballooning the fees that a client pays to have their data stored in the cloud.

Another issue affecting pricing in the cloud storage industry is the high cost of using a data replication storage method to create data resiliency. Data replication is a process by which data is duplicated exactly, unit for unit, and stored in multiple locations. Clients often pay top dollar to have their data replicated and stored with geographic diversity in mind, as this requires multiple data centers (presumably owned and operated by the cloud storage provider) to house replicated sets of a client's data. As the number of replicas of a data file increases, the cost of creating and maintaining these replicas also increases.<sup>4</sup> If a client is needing safe, secure storage that is resilient against system failure for large volumes of data, this can become cost

prohibitive. In the traditional cloud storage model, data resiliency can come at a very high price.

Luckily, Bifrost Storage Cloud is in a unique position of providing incredible cloud storage service to our clients without shouldering the financial burden of owning and operating our own data centers. Through our Distributed Architecture storage model, we achieve geographic diversity and resiliency for client data without building expensive data centers or replicating data unit for unit. It's not often that you get both a high-quality product and the lowest price with the same provider, but Bifrost Storage Cloud's progressive business model and unique technology structure allow us to do just that.



<sup>2</sup> Kerry Hawkins, Michael Restivo, "Data centers: expensive to build, but worth every penny," Jones Lang LeSalle.

<sup>3</sup> Resource Library: Data Center Costs, Data Stream Centers.

<sup>4</sup> Navneet Kaur Gill, Sarbjeet Singh, "A dynamic, cost-aware, optimized data replication strategy for heterogeneous cloud data centers," Future Generation Computer Systems, Volume 65, 2016.



## 2

# Creating a Competitive Marketplace For Your Data

Instead of relying on owning or maintaining our own large data centers to store your data, Bifrost Storage Cloud creates the conditions for a competitive marketplace for server providers around the world to bid to store your data. Using a Distributed Architecture<sup>5</sup> model of cloud storage, we ask over 20,000 storage providers to compete to

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<sup>5</sup> Distributed Storage Architecture refers to storage systems that are decentralized across multiple nodes as opposed to centralized in a single location, server or data center. The nodes work together to create resiliency against system failure. Source: Shubhani Aggarwal, Neeraj Kumar, “[The Blockchain Technology for Secure and Smart Applications across Industry Verticals](#)” in *Advances in Computers*, 2021.

house 1/80th of a block of your data, creating a competitive ecosystem for pricing. Each block of data is broken up into 80 pieces, only 30 of which are required for the block of data to be recovered. Distributing your data to over 80 different storage providers around the world allows us to cast a wide net to potential providers, creating a robust map of data nodes<sup>6</sup> across the globe, each one housing fractional pieces of your data at a market-generated price point.

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<sup>6</sup> A data node is an individual part of a larger data structure. Source: Code Academy, “[Cheatsheets / Linear Data Structures: Learn Nodes](#)”

But we don't allow just anyone to bid for your data. The safety, security, and resilience of your data are top priorities for us. Bifrost Storage Cloud considers four major factors when choosing which storage providers to store a piece of your data with: *network availability, data durability, network speed and stability, and storage speed*. Minimum performance standards must be met in all four categories for a data storage provider to be considered as a potential node for your data.

## Tracking Network Availability

Network availability is determined by the percentage of time a data storage system is up and running properly without experiencing operational errors, gauged through the measurement of system reliability called *uptime*. We experience *uptime* in our daily lives when we use the electricity in our homes; we expect the electricity in our homes to be operational in a continuous manner without interruption 24 hours, 7 days a week. When we experience a power outage in our home, knocking out our electricity (and threatening to defrost the chicken in the freezer) that would be considered a period of *downtime*. Choosing storage providers with a high percentage of uninterrupted uptime in their storage systems is imperative when determining whether or not a provider meets the reliability standards Bifrost Storage Cloud has for the storage providers that are storing your data.

Bifrost Storage Cloud measures the uptime of a potential provider against the metric of 100 percent operational standard of continuous, uninterrupted service. The minimum standard that Bifrost Storage Cloud expects for uptime is 99.9999%<sup>7</sup> or "Six Nines," which translates to daily downtime of 0.086 seconds or a total of 31 seconds in an entire year. We track the reputation of our operators based on the performance of their storage and reward the top performers with more of our client data.

## Ensuring Data Durability

*Network availability* is an important aspect when considering the reliability of data performance in the short term, but assessing *data durability* has a much longer-term impact on the longevity of the integrity of your data. If your data is available to you, but lacks comprehensive redundancy within the data storage system, the likelihood of your files becoming corrupt somewhere down the line significantly increases. What good is availability without resiliency?

Bifrost Storage Cloud uses *erasure coding* built on the Reed-Solomon family of codes to ensure the resiliency of your data, spreading pieces of your data across 80 different nodes with a built-in error correction of 30 out of 80 nodes. This means that if 30 of the nodes storing your data were to be compromised,

<sup>7</sup> Please see Bifrost Cloud's [Service Agreement](#) for more details on our uptime requirements.

you would still be able to restore all of your data files without any impact on the integrity of your data. Additionally, 50 out of 80 pieces of any given file of data would need to be completely lost for any given file to be lost. To reduce the probability of that occurring, each piece of data is stored on a different machine worldwide. When choosing storage providers, Bifrost Cloud considers geographic location to ensure the durability of your data.

By splitting up your data into 80 pieces and distributing these pieces onto individual, unique machines around the world through our storage providers, Bifrost Storage Cloud has achieved “Sixteen Nines” in data durability. Within this framework of durability, the probability of your data becoming corrupted or lost is extremely unlikely. The integrity of your data is weaved across the Bifrost Cloud map in geographically diverse nodes, like a thick blanket of finely stitched fabric. If a thread comes undone (or 30 threads), the blanket remains unaffected, completely intact.

## Assessing Network Speed and Stability

The speed of a network connection and the stability of that network also has a major impact on Bifrost Storage Cloud’s ability to reliably store client data and ensure uninterrupted access to that data. *Network speed* generally refers to the amount of time



it takes data to transfer back and forth from a device to a server<sup>8</sup>. For Bifrost Storage Cloud, network speed specifically refers to the amount of time it takes for data to transfer between users and storage providers. *Network stability* generally refers to the strength and security of a network connection.

<sup>8</sup> Barbara Zito, Samantha Allen, “Your Guide to Understanding Internet Speed,” Forbes Home, 2022.



Both network speed and stability have a direct impact on the real-time accessibility of your data stored in the cloud. Bifrost Storage Cloud measures the network speed and tests the network stability of each potential storage provider, choosing the providers that have the fastest and most reliable network connections.

## Measuring Storage Speed

*Storage speed* determines how fast a system can boot up, load, and access your data. The speed of this process is measured by a metric called “time to first byte” or TTFB.

TTFB measures the amount of time it takes a browser user to receive that first byte of data from a web server. There is a chain of operations that occurs between the user requesting data and receiving the first byte of data: determining the IP address, establishing an encrypted connection, discovering storage nodes that houses the necessary information to reconstruct the original data, filtering for a subset of nodes with the fastest/most stable connection relative to the recipient and sending the first packet<sup>9</sup> of data to the client. All of these steps generally happen in milliseconds.

Bifrost Cloud measures storage speed

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<sup>9</sup> “A data packet is a unit of data made into a single package that travels along a given network path.” Source: [Data Packet](#), Techopedia, 2016.

against the dynamic content standard of 400 milliseconds TTFB with our storage providers and at least 5 gigabits per second from the end user perspective if the client’s outgoing connection supports that speed.

## Other Factors We Consider

Bifrost Storage Cloud also considers the proximity of a provider to our storage gateway<sup>10</sup> and measures that proximity against a map of geographic diversity for your data. The gateway is where the end-user sends their objects to be run through the erasure coding process. It’s also where the end storage providers send their chunks for the object to be rebuilt. Proximity is more a measurement of how long it takes data to travel to the gateway for Bifrost Storage Cloud to rebuild an object. So we consider not just geographic proximity to a gateway but network speed as well. While geographic proximity to a gateway is a factor we consider (to ensure speedy object recovery), Bifrost Storage Cloud also makes sure all of the nodes of storage aren’t in one region of the world, which would eliminate some of the value of the distributed network model.

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<sup>10</sup>“A cloud storage gateway is a hardware- or software-based appliance located on the customer premises that serves as a bridge between local applications and remote cloud-based storage.” Source: TechTarget Contributor, [Definition: Cloud Storage Gateway](#), 2014.



# 3

## Leveraging Distributed Storage

**B**ifrost Storage Cloud uses smart technology to create the circumstances under which storage providers are bidding to safely and securely house a fraction of your data. Rather than replicating your data unit for unit, our **Distributed Architecture** model of cloud storage utilizes a method of data protection called *erasure coding*. This method of data distribution allows us to send secure fragments of your data to 80 different storage providers, creating a resilient environment for your data to withstand system

failures on an exponential level without a client absorbing the astronomical cost of replicating data. Erasure coding is more space efficient and more secure than replication<sup>11</sup>. The use of erasure coding to secure and diversify your data also drastically reduces reliance on hardware and infrastructure uptime.

<sup>11</sup> Vishesh Khemani, Ph.D., "Erasure Coding for the Masses: More Math, Less Money To Keep Your Data Safe," Medium, 2020.

# What is Distributed Architecture?

Distributed Architecture is the storage model by which Bifrost Cloud is able to safely break your data into smaller pieces through erasure coding and store these data fragments in secure nodes around the world. *Erasure coding* is a method of data protection that splits a unit of data into smaller fragments of data called “data blocks” and encodes them. Once split, these blocks of data can be sent to servers in various locations around the world through the patchwork of server providers that are all housing blocks of your data set in “nodes” on your data map. This creates a geographically diverse blanket of redundancy for your data that provides optimal resilience despite issues that might occur in one single given location.

## How does Erasure Coding Work?

*Erasure coding* is a process that splits a unit of data, for example, a file or object, into two sets of data fragments: primary data blocks and parity<sup>12</sup> blocks. The blocks are then encoded so that the primary data is recoverable even if part of the encoded data is not available, or in a worst-case scenario, is lost in one geographic location due to a catastrophic event.

<sup>12</sup> Definition: Erasure Coding, Techtargget.com.

The fundamental principles of erasure coding are mathematical in nature and rely on proven algebraic equations to fragment and encode data blocks safely and securely.

Erasure coding performs better for large-capacity data storage (more reliable, more resilient, more efficient) when tested against Redundant Array of Independent Disks (RAID) technology, which replicates data by recording identical copies of data simultaneously on two or more drives<sup>13</sup>.

## Distributed Architecture is Secure

Because your data has been distributed to at least 80 storage providers around the world, our clients have significant protection against system failure at any given geographic location. If a storage provider fails or data becomes corrupted, the original data can be reconstructed from the parity blocks stored within other “nodes” in your data map. Bifrost Storage Cloud factors significant redundancy into the mapping of your data, with a 3x geo-diverse standard for points on your data node map.

Over 50 of the 80 storage nodes in a client’s data map would have to go down at once for any bit of data to be lost, which is statistically unlikely.

<sup>13</sup> Stephen Pritchard, “Erasure coding vs RAID: Data protection in the cloud era,” Computer Weekly, 2020.

## Distributed Architecture is Self-Healing

Another benefit of Distributed Architecture is your data map is flexible and nodes move when they need to. If a catastrophic event happens somewhere in the world - a fire, earthquake, tsunami, power outage, etc - the other data centers storing your data are not likely to be affected at the same time. In the event that 30 of the 80 providers who are storing fractions of your data are down for any reason, our technology will recognize the outage and immediately redistribute your data back to a total of 80 storage providers.

The model is “self-healing,” and will shift the nodes storing your data on the map to make itself whole.

## Distributed Architecture is Fully Encrypted

Your data is completely secure and will be encrypted against being read or duplicated by any of the hosts who are storing pieces of your data. Any given host only stores an encrypted piece of your data that is unreadable without the rest that is distributed among 80 other hosts.

## Distributed Architecture is Easily Scalable

The Distributed Architecture storage model allows for rapid scale without an extreme upfront investment. Pricing and capacity are truly consumption-based. We are not an “if you build it, they will come” model, but rather a model that scales as you choose to build or downsize. This enables small storage providers to band together to share in the revenue of large-scale storage needs.

As your business grows, we grow with you. If you choose to downsize, Bifrost Storage Cloud can support you through that process too.





## 4 Focusing on a Quality Product

Many consumer-facing companies pad their pricing to include marketing costs because they prioritize reaching consumers en masse. Unlike other cloud storage providers, we consider ourselves a tool for industry professionals, not a consumer good.

As a lean, technology-focused company, Bifrost Storage Cloud doesn't sponsor sports stadiums or purchase Super Bowl Ads.

Bifrost Storage Cloud isn't inflating pricing to include a flashy marketing budget. We don't believe in punting our costs to our clients, who are industry professionals in search of the greatest quality product to support their teams. As a lean, fiscally responsible company, we are committed to the simple strategy of continually investing in the best technology out there and letting the product speak for itself.



## Conclusion

**H**uman beings make thousands of decisions every single day. We are constantly in the process of making choices about our lives that will have an impact in major and minor ways: what shoes to wear to that business meeting, whether to bring an umbrella on our walk, who to bank with, who to invite to our wedding, what we're going to eat for dinner. Bifrost Storage Cloud is here to ease your burden of choice when it comes to your cloud storage solution needs by offering the lowest price on the market while simultaneously creating greater resiliency against system failure. Through our Distributed

Architecture storage model, Bifrost Storage Cloud is able to all but eliminate the potential for data loss while significantly decreasing downtime and overall cost, factors that are fundamental to businesses that need real-time access to high volumes of precious data. The proven technology of erasure coding allows us to safely and securely create data resilience through geographic diversity for your data without Bifrost Storage Cloud having to invest in billion-dollar data centers and hardware in order to safely store your data in the cloud.

We're like a cozy, resilient, fully-encrypted security blanket of cutting-edge technology for your data at a price you can afford.