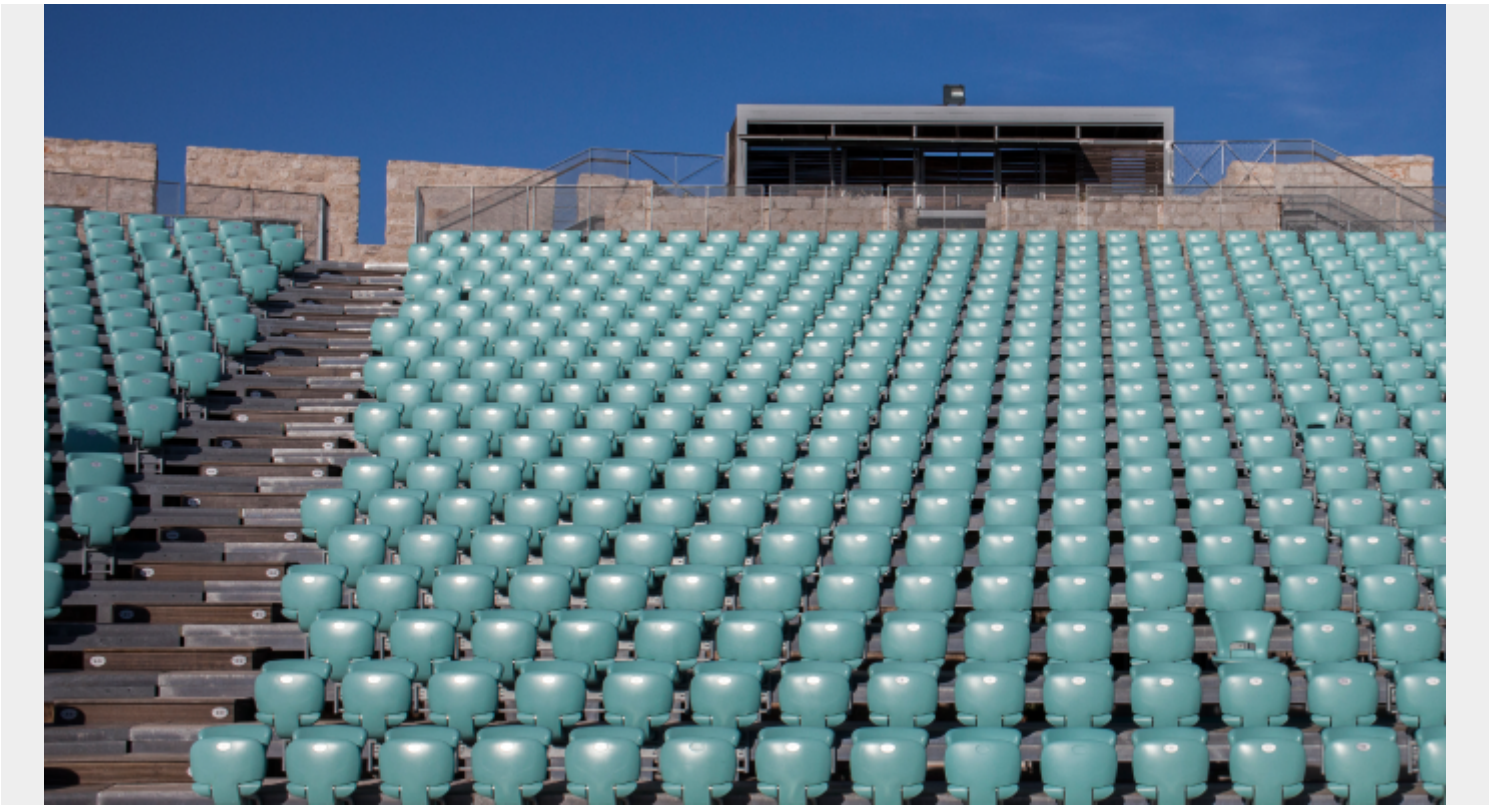
DATA CENTER TIERS: WHAT ARE THEY AND WHY ARE THEY IMPORTANT?



When dealing with Data Centers (DCs), it's helpful to understand what Data Center tiers are and how they affect IT organizations. Here's a brief overview of what a data center tier is, what data center tiers tell people about your data center, and why they're valuable to have.

(This article is part of our Data Center Operations Guide. Use the right-hand menu to navigate.)

What are data center tiers?

Data center tiers are a standard methodology for ranking data centers in terms of their potential infrastructure performance (uptime). Data center tiers are ranked from 1 to 4 and higher ranked data centers have more potential uptime than lower ranked data centers.

Here are the four currently accepted data center tier rankings from the Uptime Institute and what each ranking represents in terms of uptime and availability.

Tier 1 (Basic Capacity)	Offers dedicated space for all your IT systems, with uninterruptible power conditioned to prevent spikes that can damage your equipment. The controlled cooling control environment runs constantly, with a backup generator in case the center experiences a power outage.

Tier 2 (Redundant Capacity)	Offers the same services as Tier 1, plus partial redundancy in power and cooling components. This provides additional insurance that power or cooling needs won't shut down processing.
Tier 3 (Concurrently maintainable)	Ensures continued IT processing even during maintenance shutdowns. Equipment has dual-power supplies, so that it can be taken offline without crashing servers or cutting off network connectivity. Redundant cooling systems ensure that if one cooling unit fails, another kicks in. Tier 3 DCs are not fully fault tolerant.
Tier 4 (Fault Tolerance)	Tier 4 data centers are fault tolerant. Power and cooling components are fully redundant, serviced by two different utility power suppliers, two generators, two UPS systems, two power distribution units (PDUs), and two different cooling systems. Each data and cooling path is independent of the other so if one component fails, processing will continue uninterrupted. IT processing can only be affected if components from two different electrical or cooling paths fail.

Tier 1 data center

What is a Tier 1 (basic capacity) data center?

Tier 1 data centers offer a simple non-redundant setup for basic infrastructure. This means they have a single path for power and cooling, with no redundancy or backup.

Tier 1 benefits

Tier 1 data centers are cost-effective, simple to set up, and easy to manage.

Tier 1 drawbacks

With only **99.671% uptime**, your organization is at risk for significant outages in the case of equipment failure, power interruptions, and even routine maintenance. Most do not meet the security requirements for organizations in finance, e-commerce, or healthcare. The ability to scale is limited.

Where to use Tier 1 data centers?

Tier 1 data centers can serve the needs of start-ups and small businesses with limited budgets. Larger companies use Tier 1 data centers as inexpensive infrastructure for development and testing, or for backup archive storage of data that isn't time sensitive. If your organization won't be hobbled by IT downtime, Tier 1 data centers are a cost-effective option.

Tier 2 data center

What is a Tier 2 (redundant capacity) data center?

A step up from Tier 1 facilities are those classed as Tier 2. They improve reliability, with some redundancy in heating and cooling through an uninterruptible power supply. These facilities have

N+1 redundancy, meaning if a component (N) fails, there is at minimum another independent backup component (+1).

Tier 2 benefits

These data centers offer increased reliability and reduced downtime with **99.741% uptime**, translating to 22 down hours per year. While costing more than a Tier 1 data center, they offer a good balance between being affordable and reducing downtime risks.

Tier 2 drawbacks

Because Tier 2 data centers are not fully fault-tolerant, downtime can still occur due to maintenance, unexpected errors, and power outages. Scalability is better than Tier 1, but is still limited. Security requirements for finance, healthcare, and e-commerce are still not met.

Where to use Tier 2 data centers?

Small- to medium-sized businesses may find the cost versus downtime risk to be acceptable. Larger organizations may find Tier 2 data centers to be adequate for non-critical operations and for non-time-sensitive data storage.

Tier 3 data center

What is a Tier 3 (dual-powered components) data center?

A Tier 3 data center is a high-performance facility that can support your most critical business operations. They offer much higher uptime and improved fault tolerance.

Tier 3 benefits

Every critical component has N+1 redundancy for an infrastructure that can be maintained without causing downtime. The reliability of **99.982% uptime** translates to about 1.6 hours of downtime a year. Multiple paths for power and cooling ensure nearly uninterrupted operations. Growing businesses will appreciate the ability to scale to meet IT demands.

Tier 3 drawbacks

You will have higher costs, due to the capital investments and operational expenses of the infrastructure needed for redundancy. The infrastructure is also more challenging to manage, requiring skilled personnel. While downtime is minimal, Tier 3 data centers are not fully fault-tolerant.

Where to use Tier 3 data centers?

Companies in highly regulated industries, like financial services and healthcare, benefit from the high uptime offered by Tier 3 data centers. High traffic websites, from e-commerce and streaming services to SaaS companies experience revenue loss with downtime, so the additional cost is worth it. These data centers are more compliant with regulations and offer good backup capabilities.

Tier 4 data center

What is a Tier 4 (fault-tolerant design) data center?

With 2N+1 redundancy, in which two independent systems run and have an additional backup, it offers the most robust infrastructure available. Tier 4 data centers are fault-tolerant and maximize uptime, allowing the data center to function even if multiple systems fail.

Tier 4 benefits

With **99.995% uptime**, downtime per year is just 26.3 minutes. Every power, cooling, and network component has a duplicate, so maintenance will not disrupt operations and operations are continuous even if multiple systems fail for resilience in extreme conditions. They offer maximum reliability, fault tolerance, and compliance with stringent regulatory requirements for critical applications.

Tier 4 drawbacks

High operational costs and complexity are the two greatest drawbacks of a Tier 4 data center. It may be well worth it for mission-critical data and operations.

Where to use Tier 4 data centers?

Financial institutions like banks and stock exchanges, mission critical SaaS companies, telecom, energy, and global cloud providers that cannot tolerate outages and downtime need Tier 4 data centers.

Data center tiers scored by uptime

Data center uptime is expressed as the percentage of time each year that your data center is available, with each higher data center tier having a higher uptime percentage.

Here are the standard uptime percentages along with the maximum downtime you can expect to see in each data center tier.

- Tier 1 DCs have a 99.671% uptime percentage per year. Maximum total yearly downtime = 1729.2 minutes or 28.817 hours each year
- Tier 2 DCs have a 99.741% uptime percentage per year. Maximum total yearly downtime = 1361.3 minutes or 22.688 hours
- Tier 3 DCs have a 99.982% uptime percentage per year. Maximum total yearly downtime = 94.6 minutes or 1.5768 hours
- Tier 4 DCs have a 99.995% uptime percentage per year. Maximum total yearly downtime = 26.3 minutes or 0.4 hours

Note that your mileage may vary (YMMV) when using any one of these DC tier models. Uptime percentages for tier 3 and tier 4 are more accurate and consistent because of their high degree of redundancy, while tier 1 and tier 2 DCs could experience longer processing outages depending on what causes their downtime.

What do you do with a data center tier ranking?

It's also important to understand your business needs for using a tier 1, 2, 3, or 4 data center provider. A tier 1 or 2 data center may work well for a smaller company that doesn't have full 24×7 requirements and can stand being down after-hours or on weekends for maintenance. In that case, it may not be worth it to put in the extra investment to run in a tier 3 or 4 environment.

However, if you're a large multi-national organization that does business around the clock and you have several critical applications that can never be down, you may want to opt for hosting your apps in a tier 3 or 4 data center or make your in-house data center tier 3 or 4 compliant.

Data center tier rankings are also important in several different situations, including the following:

- When planning a data center move to an external provider or to a cloud provider, data center rankings help you understand the risks involved in using these providers
- When building or redesigning your own data center, to provide a blueprint for its setup and configuration that meets your needs
- When you're hosting a critical application for a customer, they will want to know what your data center ranking is, who certified your DC, and what certification standard was used
- In risk evaluation scenarios when you have to justify network availability to management

Difference between data center tiers

Tier Level	Uptime	Redundancy Level	Cost	Best For	Drawbacks
Tier 1	99.671%	No redundancy	Lowest	Small businesses with limited budgets and minimal need for uptime	Prone to downtime; limited redundancy for power and cooling
Tier 2	99.741%	N+1 redundancy	Low to Moderate	Small- to medium-sized businesses needing basic redundancy	Higher costs than Tier 1; may not meet high uptime requirements
Tier 3	99.982%	N+1 redundancy	Moderate to high	Highly regulated businesses and high traffic websites where downtime damages the business	Higher costs; greater complexity; need for specialized expertise
Tier 4	99.995%	2N+1 redundancy	High	Businesses where connectivity is mission-critical and where stringent regulations for connectivity and security apply	Very high cost; extremely complex

Choosing the right tier for your business

Right-sizing your data center to your needs and budget is an important decision.

- **Small Businesses**: Businesses that can handle occasional downtime and that need cost-effective infrastructure may benefit from Tier 1 or 2 data centers. If cost is more important than reliability, these facilities are adequate.
- **Mid-Sized Companies**: Tier 2 or 3 data centers can support small- to medium-sized companies with growing IT needs. They are also adequate for non-critical and non-time-sensitive tasks. They can help companies strike a balance between budget and uptime, providing the ability to scale as business grows.
- **Large Enterprises**: When downtime can severely disrupt business, damage customer relationships, and create costly security and compliance issues, Tier 3 or 4 data centers are strongly recommended. While they cost more, the costs of downtime can be catastrophic.

The higher tiers of data centers offer additional services, such as data center automation. And as the complexity of your enterprise data needs increases, you may find it worthwhile to bring in professionals to help with data center management and automation.

Who certifies a data center?

Data centers are generally rated and certified using either the Uptime Institutes' standard tier classification system or the TIA/942 standard. Data centers are certified against these standards and issued a rating.

When hiring someone to certify your data center, make sure you know their reputation in the industry and which standard they are using.

Related reading

- BMC IT Operations Blog
- BMC AIOps Blog
- Introduction to Data Center Operations
- How Data Center Colocation Works
- How Data Center Cooling Works
- Data Infrastructure Management
- Data Center Management Tools