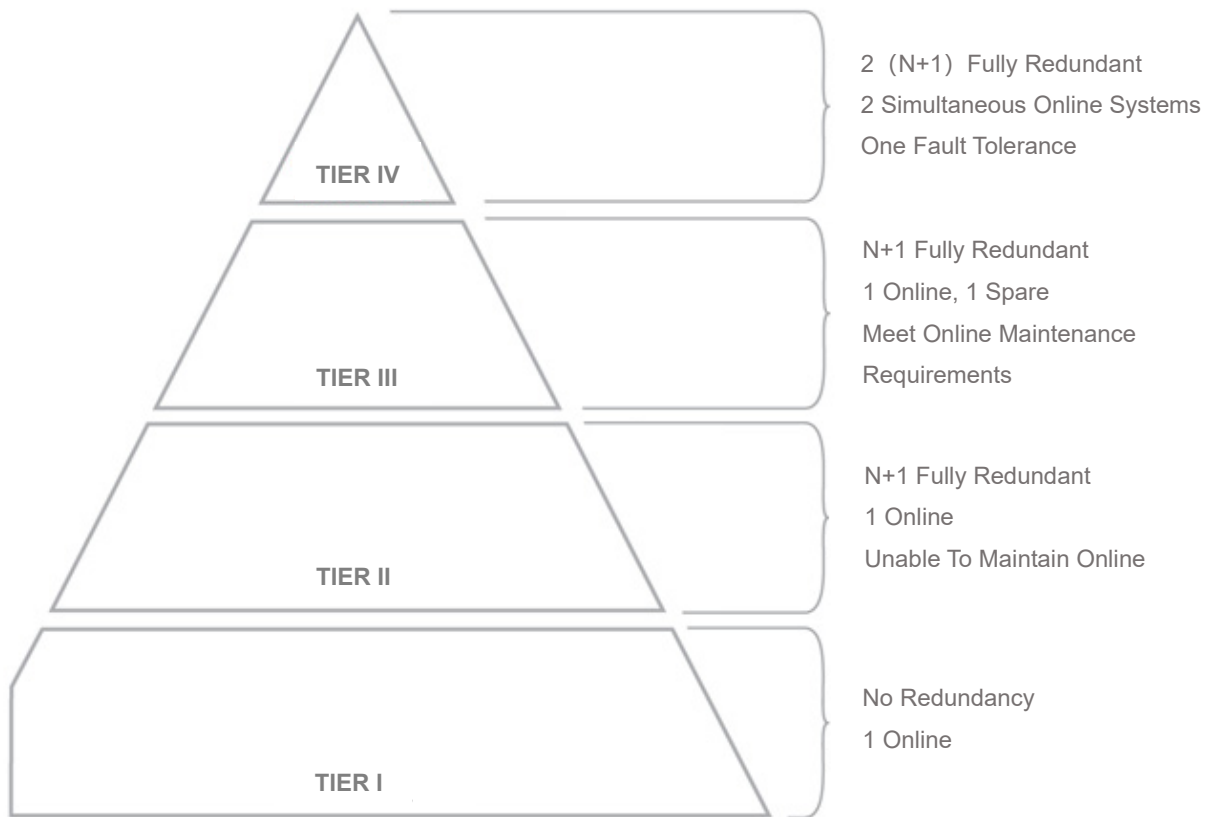


Industry Application Guide: TIER Standard For Micro Data Centers



NOVEMBER 2019

In the critical site infrastructure of data centers, the Tier standard released by Uptime Institute is currently the most widely used grading standard in the world to evaluate the capacity and availability of data center systems. It provides an objective and effective way for professional designers, data center operations staff, and managers to determine the expected performance of different data center infrastructure design topologies.

Now, with the rapid development of edge computing, the process of Micro data center commercialization will also accelerate. It seems necessary to apply the Tier standard to Micro data center.

What is a micro data center?

Micro data center, a self-contained converged IT and facilities solution that incorporates compute, network, storage, power, cooling, security and unified management control, has become an answer to this challenge in that they are easily installed, self-contained, scalable and remotely managed, to provide customers an ideal solution for distributed local IT and edge computing applications.



Easy Deployment

Pre-manufactured and fully tested means that no on-site engineering needed to activate the product. Within one day, you can deploy the IT equipments and quickly power on your business.

Easy Management

Design once and deploy anywhere. By this standardized architecture and remote monitoring access platform, you can gain control of these critical assets, reduce risks and operational costs, and improving service levels.

Easy Expansion

A stand alone full function solution. You can plan and invest your IT assets step by step while your business grows. Buy small and scale to big. Invest only when necessary.

Micro Data Centers are the turnkey solution for enterprise and SMB clients. Small enough to deploy anywhere, sturdy enough to support enterprise-class racks gear independent of building cooling with integrated power, cooling, security and access control. The standardized modules make it flexible to integrate and pre-test everything in a factory environment, forming from half cabinet to multiple cabinets, and quickly delivered with the all-in-one portability.

How does micro data center need to be designed to meet the Tier standard?

In the past, Tier standards were mostly used in medium and large data centers, and relying on a professional team to complete complex overall architecture design, but in the micro data center, due to its

productization and prefabrication characteristics, manufacturers may need to complete the design. For the micro data centers, we have a topology definition that satisfies the Tier standard.

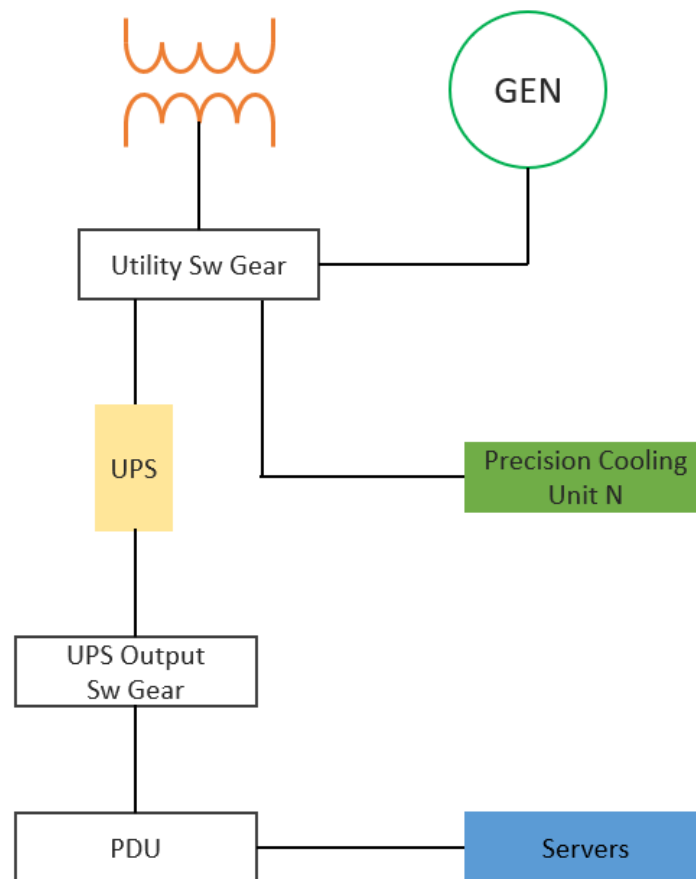
Tier I: Basic infrastructure

Definition:

- Including a dedicated space for an IT system.
- Powering IT system from a single UPS system via a distribution path.
- Cooling system with sufficient cooling capacity.
- 12 hours fuel storage for on-site power production (engine generator, fuel cell).

Key point: No redundant infrastructure, require power production.

Topology:



Availability: Minimum, arbitrary accident can easily lead to IT service disruption.

Application scenarios: micro data centers such as site-level data centers and small and medium-sized enterprise data centers.

Note: For a micro data center, a single UPS and power production can meet the basic capacity needs, but precision cooling unit may need more and it's a complete mechanical refrigeration system.

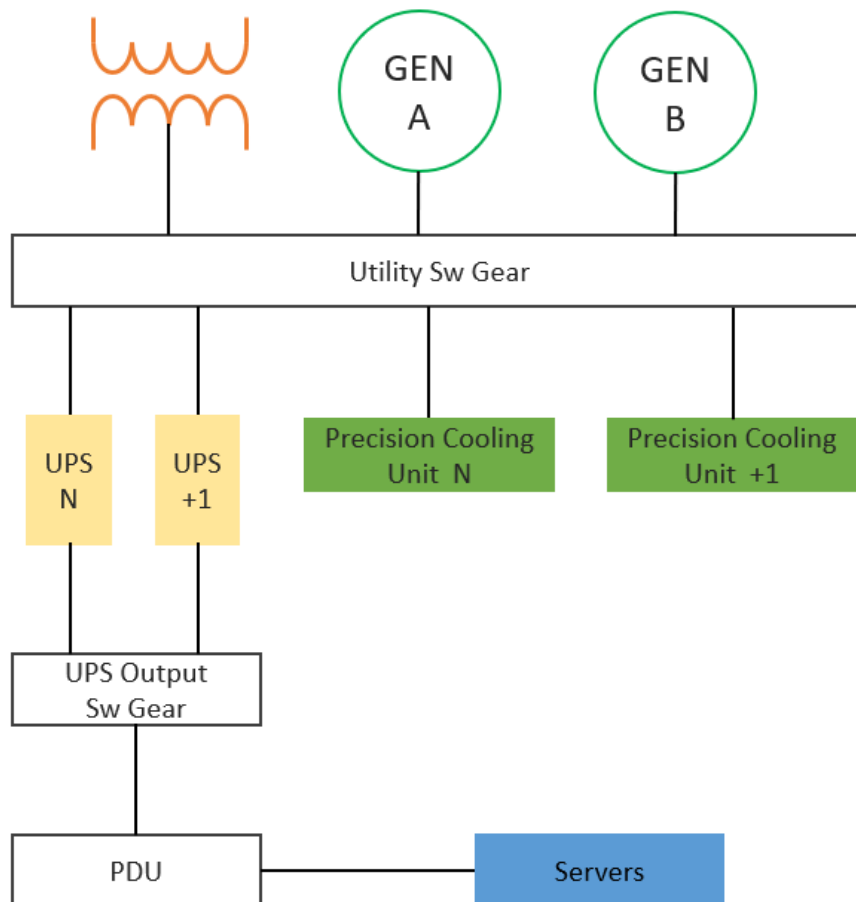
Tier II: redundant infrastructure capacity components

Definition:

- Meet all the needs of Tier I.
- Key facilities such as UPS, precision cooling unit and power production require redundancy(N+1).
- Distribution path is still single.

Key point: UPS and precision cooling unit are all N+1 configurations, N meets basic capacity requirements, Two power production form a 1+1 redundant backup.

Topology:



Availability: Lower, redundant components can be planned to be removed for maintenance without causing IT equipment to shut down, but unplanned equipment or distribution path failures can cause IT equipment to shut down.

Application scenarios: Micro data centers such as regional data centers and medium-sized enterprise data centers.

Note: Redundant UPS and power production components often mean more of the same set of components

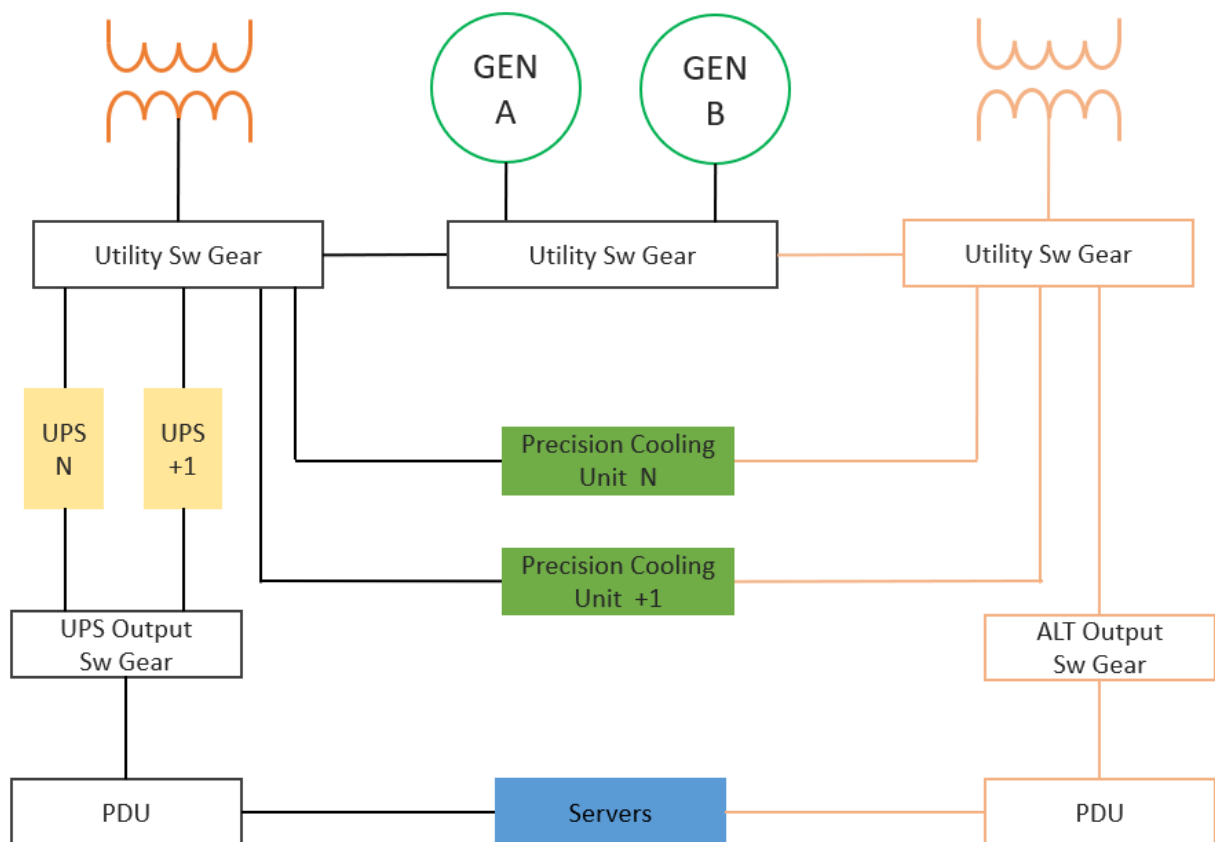
Tier III: Concurrently Maintainable Infrastructure

Definition:

- Meet all the needs of Tier II.
- Have multiple independent distribution paths to serve IT equipment.
- IT equipment is required to support dual power inputs. For IT equipment that does not support dual power supplies, rack-level STS switches need to be configured.
- Cooling unit also requires dual power input.

Key point: Both IT equipment and cooling unit need to be configured with two power input paths.

Topology:



Availability: High, all single components and distribution paths can be systematically removed from the system without affecting any critical environment, but unplanned failures can cause IT equipment to shut down.

Application scenarios: regional core data centers, Key industry data center.

Note: If the system is a 1+1 backup consisting of two precision cooling units, then they can be used without dual power input, just connect them to different power supply paths.

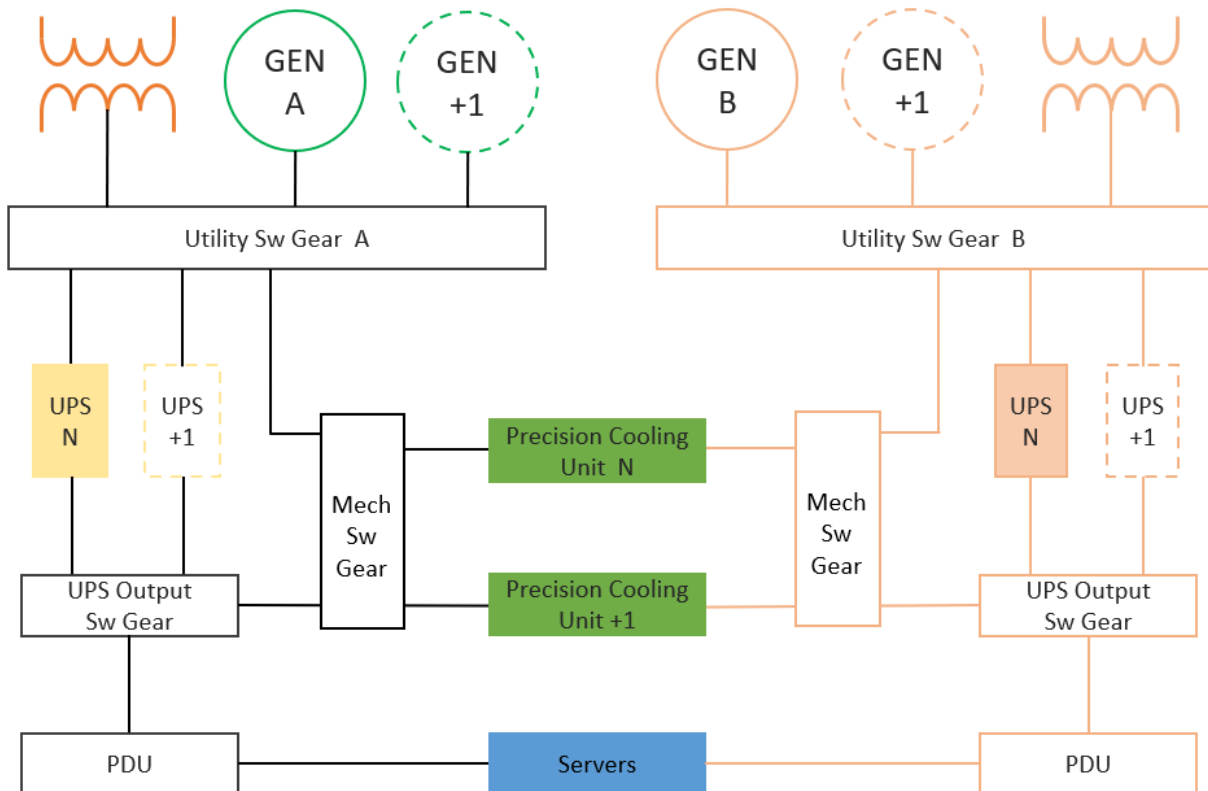
Tier IV: Fault-tolerant infrastructure

Definition:

- Meet all the needs of Tier III.
- Simultaneously having multiple independent, physically isolated systems to provide redundant capacity components and multiple independent, physically isolated distribution paths while servicing IT equipment.
- The system is capable of continuous cooling, providing a stable environmental condition for all critical spaces to meet the maximum temperature variation of the IT equipment ASHRAE.

Key point: Systems and distribution paths that are mutually backed up must be physically isolated (separated) from each other, to prevent any single event from affecting both systems or two distribution paths simultaneously.

Topology:



Availability: The highest, any single infrastructure equipment and path failure will not cause service disruption, and can be maintained online.

Application scenario: Key industry data center, cloud computing data centers, etc.

Note:

- Because of the small IT capacity of micro data center, require only 1 unit for UPS and power production to meet basic capacity requirements.
- In terms of the redundancy of UPS, 1+1 is more reliable than N+1($N \geq 2$, N meets basic capacity requirements), the best choice for UPS in micro data center is 1+1.
- The Tier IV will rarely be used on micro data centers, if any, the specific design of continuous cooling needs to be considered, It is the easiest to provide power for precision cooling by UPS, but not necessary.
- Micro data centers often cannot contain all the components that meet the Tier Standard. It is a feasible solution to reserve the interfaces of the corresponding components.
- The topology and content of the above related Tier Standards are ultimately subject to the release of Uptime Institute.

Some common misunderstandings about Tier:

1. The number of components determines the Tier grade

Tier grade is an assessment of the performance of the data center's overall infrastructure, not a checklist or instruction manual. However, some people directly use "N" to define availability. They think that N is the minimum number of components that meet the load requirements, and as long as more components are added, the availability is improved, such as N+1, N+X, 2N or 2(N+ 1). However, increasing the number of components does not determine or guarantee a higher Tier rating. Because Tier also includes an assessment of the distribution path and other subsystem elements, not just the "N". The Tier level is determined by the configuration and connection of the components in the redundant distribution path, rather than relying solely on the number of devices.

2. Tier grade predicts annual downtime

As early as 2009, the Tier standard removed the reference for the "annual downtime forecast". Tier Standard: Topology states that the Tier availability level must correspond to a clear system function result, ie a clear performance goal, such as: redundant capacity, simultaneous maintenance, or fault tolerance. However, even if a Tier IV data center reaches the level of fault tolerance, there may be a probability of downtime due to operational and management issues, and the impact of human influence cannot predict the probability.

3. TIA-942 is the specific guidance document for the Tier standard

In 2014, the Uptime Institute and the American Telecommunications Association (TIA) reached an agreement, and the two sides began to clearly distinguish their respective benchmark systems to avoid industry confusion and clear definition of responsibilities. In other words, the TIA-942 standard

has nothing to do with the Tier standard of the Uptime Institute.

4. The source of the utility determines the Tier grade

In the Tier standard, the only reliable source of power for data centers is Power generation equipment, because utility power is often subject to unplanned outages, even where the so-called grid is reliable. The Tier standard does not need to consider the utility power at all. The reason for using the utility power as the main source of electricity is simply because of the economics, and the utility power will not affect the Tier level.

Reference:

“Data Center Site Infrastructure Tier Standard: Topology”

—— Uptime Institute

About Attom technology

We design and deliver Prefabricated Micro Modular Data Center solutions. Together with solid experience of 16+ years engineering and 20+ years manufacturing, we integrate resources from industry to build PFMDC solutions that help simplify IT systems for the distributed edge sites.

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