سازمان نظام صنفی رایانه ای کشور

وزارت ارتباطات و فناوری اطلاعات
سازمان فناوری اطلاعات ایران

DCAS

نظام ممیزی و رتبه بندی مراکزداده

سازمان تظام صنفی رایانه ای کشور

وزارت ارتباطات و فناوری اطلاعات
سازمان فناوری اطلاعات ایران

Uptime Institute®

Uptime Tier standard:2018

Datacenter Topology

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- BICSI002-2019 Data Center Design-2020
- EN-50600 Management and Maintenance of Data Center-2019
- ATS: Accredited Tier Specialist-2018
- CDCP: Certified Data Center Professional - 2016
- Telecommunications Distribution Methods -2015
- BICSI002-2011 Data Center Design and Implementation Best Practices-2012
- TIA-942-A Data Center Design -2009

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- Continuous Cooling
- Makeup Water
- Tier Requirements for Power
- Engine-Generator Ratings
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References

- Uptime Institute – Tier Standard: Topology- 2018: Data Center Site Infrastructure
- ATD Technical Paper Series: Engine-Generator Ratings- 2017
- ATD Technical Paper Series: Makeup Water-2017
- ATD Technical Paper Series: Continuous Cooling-2017

Scope of This Presentation

- This Presentation Is Suitable For:
  - IT and Data Center Managers of Any Level
  - Data Center Design Specialists and Contractors
  - Anyone Interested In Data Center Standards

- It Covers:
  - Uptime Tier standard-Datacenter Topology:2018

- It Is Not Intended To:
  - Educate On Data Center Design and Construction

Introduction

- The object of The Institute Tier Standard:

  Topology is to comparing the functionality, capacity, and expected availability (or performance) of a particular site infrastructure design topology against other sites, or for comparing a group of sites.

- The Tier topology rating for an entire site is constrained by the rating of the weakest subsystem that will impact site operation

What is The purpose of this standard ?

- The purpose of this standard is to equip design professionals, data center operators, and non-technical managers with an objective and effective means for identifying the anticipated performance of different data center site infrastructure design topologies.

Tier Certification

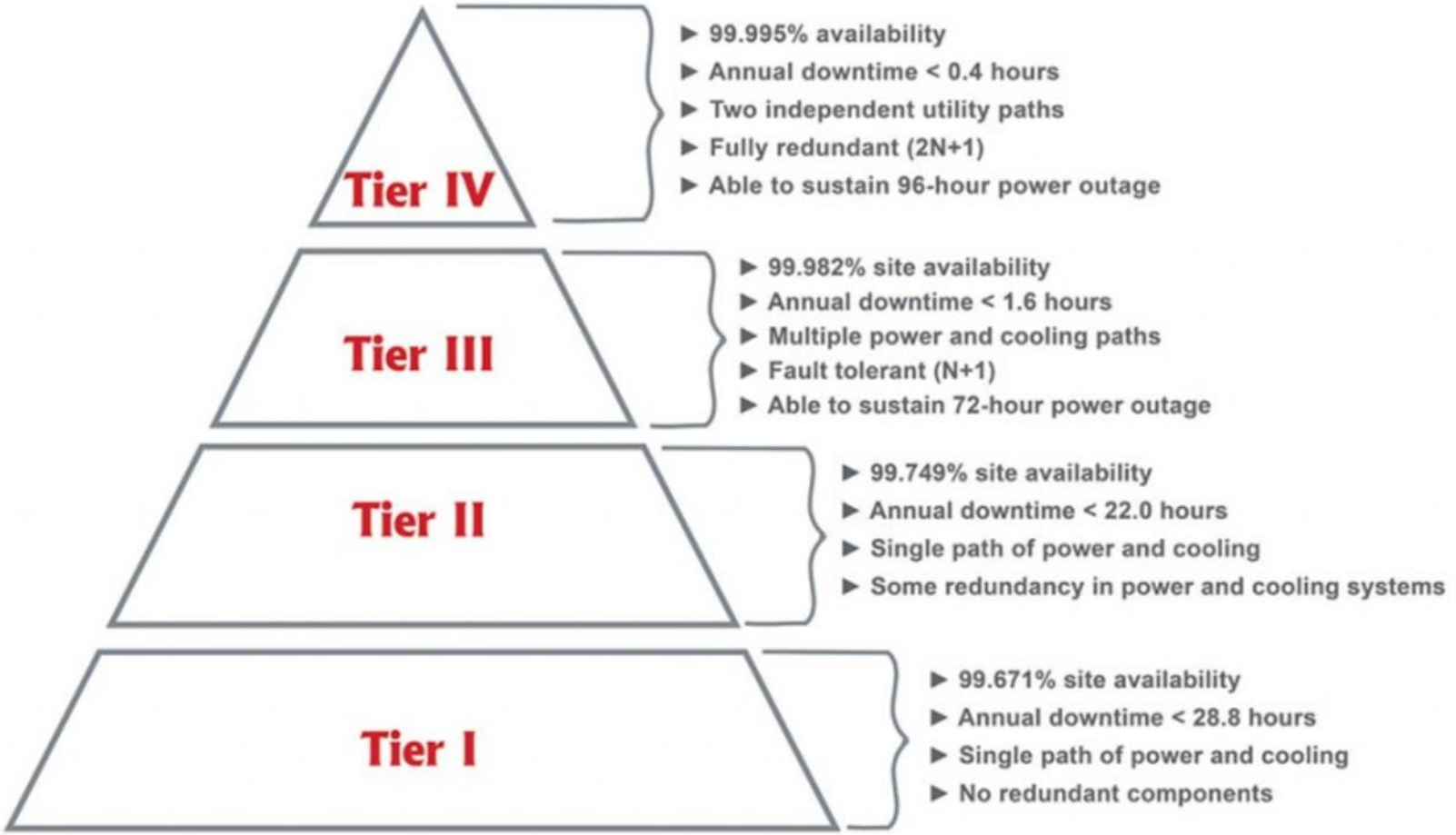
Tier Certification of Design Documents

Tier Certification of Constructed Facility

Tier Certification of Operational Sustainability

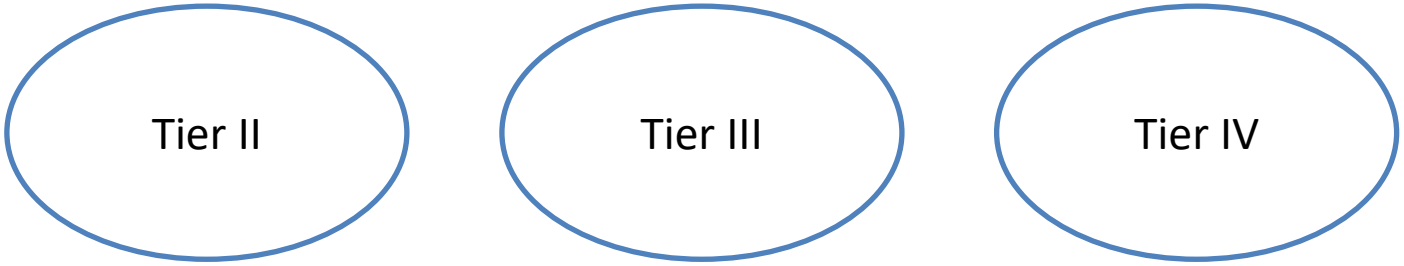
Management and Operations (M&O) Stamp of Approval

The old approach

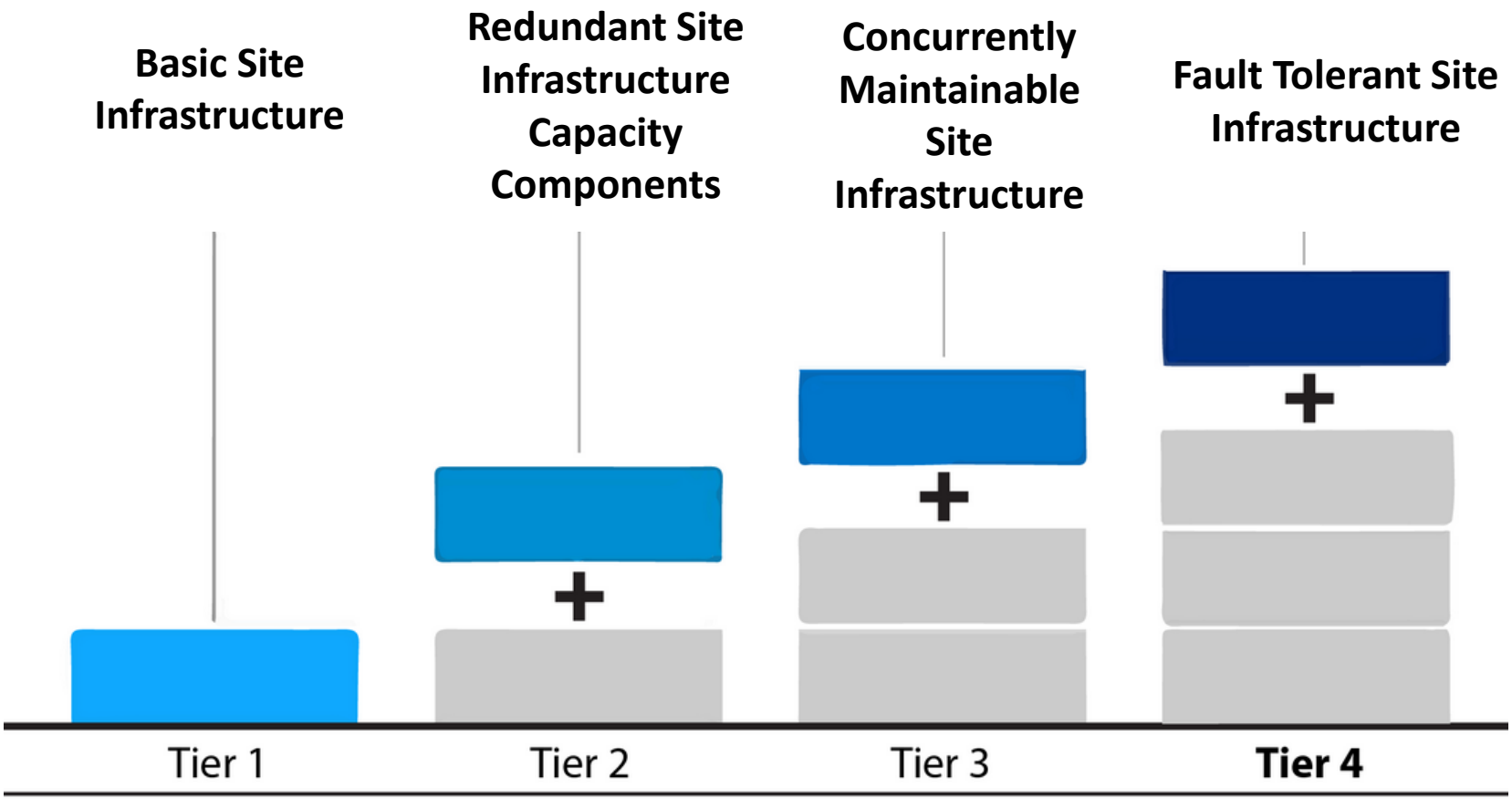


Which tier?

2N+1 component & distribution path?



Site Infrastructure Tier Standards



Tier I: Basic Site Infrastructure

❖ **The fundamental requirement**

- A Tier I basic data center has non-redundant capacity components and a single, non-redundant distribution path serving the computer equipment.
- Twelve hours of on-site fuel storage for on-site power production.

❖ **The performance confirmation tests**

- There is sufficient capacity to meet the needs of the site.
- Planned work will require most or all of the site infrastructure systems to be shut down affecting computer equipment, systems, and end users.

Tier I: Basic Site Infrastructure

❖ **The operational impacts**

- The site is susceptible to disruption from both planned and unplanned activities. Operation (Human) errors of site infrastructure components will cause a data center disruption.
- An unplanned outage or failure of any capacity system, capacity component, or distribution element will impact the computer equipment.
- The site infrastructure must be completely shut down on an annual basis to safely perform necessary preventive maintenance and repair work.
- Urgent situations may require more frequent shutdowns.
- Failure to regularly perform maintenance significantly increases the risk of unplanned disruption as well as the severity of the consequential failure.

Tier II: Redundant Site Infrastructure Capacity Components

❖ **The fundamental requirement**

- A Tier II data center has redundant capacity components and a single, non-redundant distribution path serving the computer equipment.
- Twelve hours of on-site fuel storage for ‘N’ capacity.

❖ **The performance confirmation tests**

- Redundant capacity components can be removed from service on a planned basis without causing any of the computer equipment to be shut down.
- Removing distribution paths from service for maintenance or other activity requires shutdown of computer equipment

Tier II: Redundant Site Infrastructure Capacity Components

❖ **The operational impacts**

- The site is susceptible to disruption from both planned activities and unplanned events. Operation (Human) errors of site infrastructure components may cause a data center disruption.

- An unplanned capacity component failure may impact the critical environment.
- An unplanned outage or failure of any capacity system or distribution element will impact the critical environment.

- The site infrastructure must be completely shut down on an annual basis to safely perform preventive maintenance and repair work.

- Urgent situations may require more frequent shutdowns.

- Failure to regularly perform maintenance significantly increases the risk of unplanned disruption as well as the severity of the consequential failure

Tier III: Concurrently Maintainable Site Infrastructure

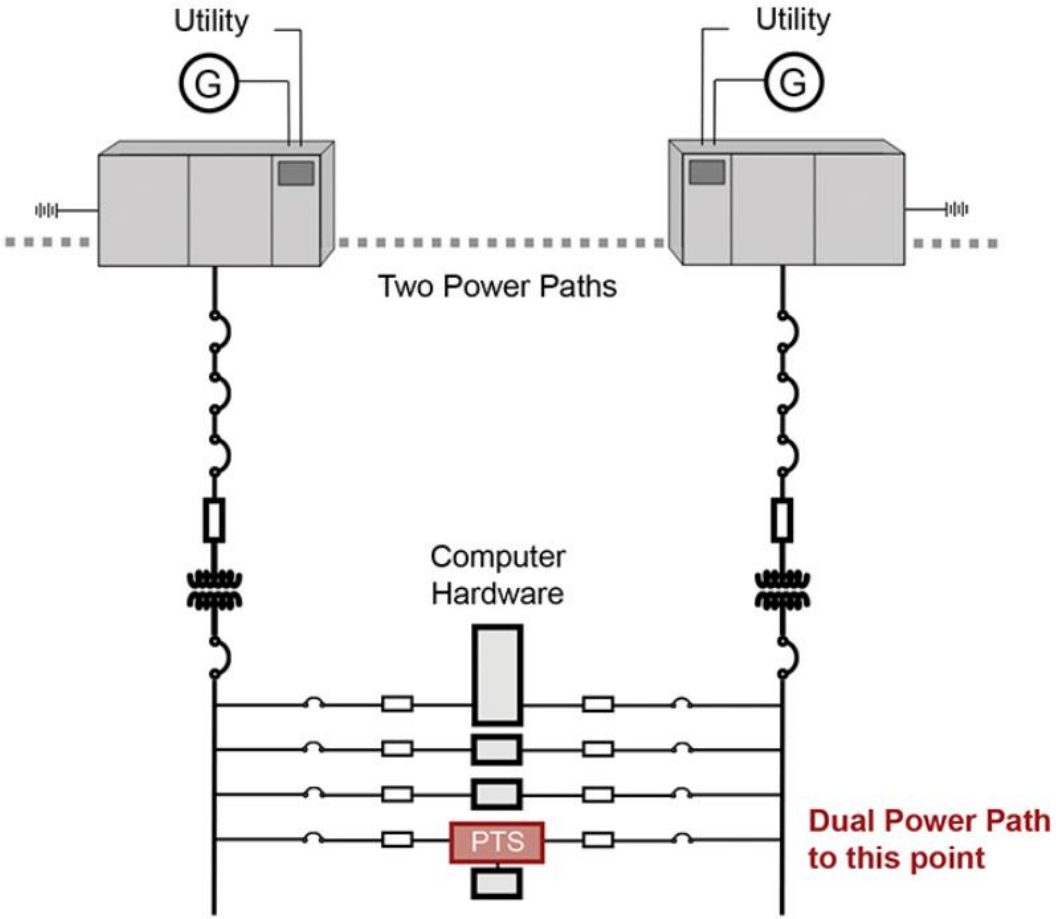
❖ **The fundamental requirements**

- A Concurrently Maintainable data center has redundant capacity components and multiple independent distribution paths serving the computer equipment. For the electrical power backbone and mechanical distribution path, only one distribution path is required to serve the critical environment at any time.

- All IT equipment is dual-powered and installed properly to be compatible with the topology of the site's architecture. Transfer devices, such as point-of-use switches, must be incorporated for critical environment that does not meet this specification.

- Twelve hours of on-site fuel storage for 'N' capacity.

Tier III: Concurrently Maintainable Site Infrastructure



Tier III: Concurrently Maintainable Site Infrastructure

❖ **The performance confirmation tests**

- Each and every capacity component and element in the distribution paths can be removed from service on a planned basis without impacting any of the critical environment

- There is sufficient permanently installed capacity to meet the needs of the site when redundant components are removed from service for any reason.

Tier III: Concurrently Maintainable Site Infrastructure

❖ **The operational impacts**

- The site is susceptible to disruption from unplanned activities. Operation errors(human) of site infrastructure components may cause a computer disruption.
- An unplanned outage or failure of any capacity system will impact the critical environment .
- An unplanned outage or failure of a capacity component or distribution element may impact the critical environment.
- Planned site infrastructure maintenance can be performed by using the redundant capacity components and distribution paths to safely work on the remaining equipment.
- During maintenance activities, the risk of disruption may be elevated.

Tier IV: Fault Tolerant Site Infrastructure

❖ **The fundamental requirements**

- A Fault Tolerant data center has multiple, independent, physically isolated systems that provide redundant capacity components and multiple, independent, diverse, active distribution paths simultaneously serving the computer equipment. The redundant capacity components and diverse distribution paths shall be configured such that "N" capacity is providing power and cooling to the computer equipment after any infrastructure failure.

Tier IV: Fault Tolerant Site Infrastructure

❖ **The fundamental requirements**

- All IT equipment is dual powered and installed properly to be compatible with the topology of the site's architecture. Transfer devices, such as point-of-use switches, must be incorporated for critical environment that does not meet this specification.
- Complementary systems and distribution paths must be physically isolated from one another (compartmentalized) to prevent any single event from simultaneously impacting both systems or distribution paths.
- Continuous Cooling is required.
- Twelve hours of on-site fuel storage for 'N' capacity.

Tier IV: Fault Tolerant Site Infrastructure

❖ **The performance confirmation tests**

- A single failure of any capacity system, capacity component, or distribution element will not impact the critical environment.
- The infrastructure controls system demonstrates autonomous response to a failure while sustaining the critical environment.
- Each and every capacity component and element in the distribution paths can be removed from service on planned basis without impacting any of the critical environment.
- There is sufficient capacity to meet the needs of the site when redundant components or distribution paths are removed from service for any reason.
- Any potential fault must be capable of being detected, isolated, and contained while maintaining N capacity to the critical load.

Tier IV: Fault Tolerant Site Infrastructure

❖ **The operational impacts**

- The site is not susceptible to disruption from a single unplanned event.
- The site is not susceptible to disruption from any planned work activities.
- The site infrastructure maintenance can be performed by using the redundant capacity components and distribution paths to safely work on the remaining equipment.
- During maintenance activity where redundant capacity components or a distribution path shut down, the computer equipment is exposed to an increased risk of disruption in the event a failure occurs on the remaining path. This maintenance configuration does not defeat the Tier rating achieved in normal operations.
- Operation of the fire alarm, fire suppression, or the emergency power off (EPO) feature may cause a data center disruption

Continuous Cooling

- Continuous Cooling is defined as the ability to provide a stable thermal environment for the critical IT equipment without any interruption
- Tier IV is the only Tier that requires Continuous Cooling.
- However, Uptime Institute recommends Continuous Cooling at densities beyond 4 kilowatts (kW) per rack, regardless of the Tier level.

Continuous Cooling - Example

- **Best practice**

  As a point of reference, Uptime Institute conducted a demonstration on a 6-kW/rack average computer room. Intake air temperatures in the computer room exceeded the top value in this range within 60 seconds after a loss of cooling or even after just loss of air movement. Additionally, this demonstration showed that a 1-minute loss of cooling required 20 minutes to recover.

Makeup Water

- For all Tier sites using evaporative cooling, on-site, backup makeup water storage is required for 12 hours according to the Tier objective. Accordingly,

- Tier III and Tier IV data centers, the makeup water system must also be Concurrently Maintainable and Fault Tolerant as required to the point of delivery for a minimum duration of 12 hours.

Tier Requirements for Power

- The only reliable sources of power for a data center is the on-site energy production.

- Tiers requires data centers to have onsite power generation system to support the data center's normal operation, public electric utility system are not required. however, most tier compliant data centers choose to utilize a public electrical utility to provide power to the data center for economic reasons. Typically, it is less costly to purchase power from a local electrical utility than to run the onsite generation system.

- Engine generators must have no runtime limitations at N unit.

Engine-Generator Ratings

- Engine generators and their ratings are governed by International Organization for Standardization (ISO)® Standard 8528-1.
  - Emergency Standby Power
  - Prime Power
  - Continuous Power

Engine-Generator Ratings

- **Emergency Standby Power**

  The maximum power for which an engine-generator is capable of delivering for up to 200 hours per year.

  The allowable average power output over a 24-hour run period is 70% of the standby rating unless otherwise agreed to by the RIC manufacturer.

Engine-Generator Ratings

❖ **Prime Power**

- The maximum power for which an engine-generator is capable of delivering continuously with a variable load for an unlimited number of hours.

- The allowable average power output over a 24-hour run period is 70% of the prime rating unless otherwise agreed to by the RIC manufacture

❖ **Continuous Power**

- The maximum power for which an engine-generator is capable of delivering continuously for a constant load for an unlimited number of hours

Example

Manufacturer Rating	Kilowatts (kW)	De-rating for Variable Load (kW)	Runtime limit
Standby	2,000	2,000 x 0.7 = 1,400	200 hours
Prime	1,850	1,850 x 0.7 = 1,295	None
Continuous	1,600	None	None

Engine-Generator Ratings

Engine-Generator Requirements	Tier I	Tier II	Tier III	Tier IV
Rating to Support Design Load	Any; up to nameplate rating to support design load	Any; up to nameplate rating to support design load	Capable of supporting design load for unlimited hours at site conditions	Capable of supporting design load for unlimited hours at site conditions
Continuous	No additional requirement for hours of operation limitations		Full nameplate capacity	
Prime			Option 1: 70% of nameplate capacity Option 2: Larger capacity than Option 1 with manufacturer letter	
Standby			Can be used for Tier III and Tier IV with manufacturer letter; Tier Certification capacity dependent on manufacturer letter	
Derating for Site Conditions	Additional derating may be required due to site conditions (e.g., ambient temperatures, elevation)—consult manufacturer requirements			

Tier Requirements Summary

	Tier I	Tier II	Tier III	Tier IV
Minimum Capacity Components to Support the IT Load	N	N+1	N+1	N After any Failure
Distribution Paths - Electrical Power Backbone	1	1	1 Active and 1 Alternate	2 Simultaneously Active
Critical Power Distribution	1	1	2 Simultaneously Active	2 Simultaneously Active
Concurrently Maintainable	No	No	Yes	Yes
Fault Tolerance	No	No	No	Yes
Compartmentalization	No	No	No	Yes
Continuous Cooling	No	No	No	Yes

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