

the **Availability Digest**

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The Uptime Institute is a consortium of companies that engages in education, publication, consulting, certifications, conferences, and seminars for the enterprise data-center industry and for data-center professionals. Founded in 1993, it is headquartered in New York City and has offices in San Francisco, Washington, D.C., Boston, Seattle, Denver, London, São Paulo, Dubai, and Singapore.



The Institute offers widely adopted Tier certification for data centers via the creation and administration of its Tier standards, "Tier Standards & Certification for Data Center Design, Construction, and Operational Sustainability." The standards fall into two categories – data-center topology and data-center operational sustainability.

Data Center Site Infrastructure Tier Standard: Topology

The Tier Standard for Topology is detailed in the Uptime Institute's document entitled "Data Center Site Infrastructure Tier Standard: Topology." This standard forms the basis for comparing the functionality, capacity, and expected availability of a particular site infrastructure. It defines four classifications (Tiers I through IV, with Tier IV being the highest rating) based on increasing levels of redundant capacity components and distributed paths.

The Tier topology rating for an entire site is constrained by the rating of the weakest subsystem that will impact site operations. For example, a site with a robust Tier IV UPS configuration and a Tier II chilled-water system yields a Tier II rating.

The Tiers are defined as follows:

Tier I: Basic Site Infrastructure

A Tier I basic data center has non-redundant capacity components and a single non-redundant distribution path serving the critical environment.

The data center includes a dedicated space for IT systems, a UPS to filter power feeds, dedicated cooling equipment, and a generator to protect IT functions from extended power outages.

Tier II: Redundant Site Infrastructure Capacity Components

A Tier II data center has redundant capacity components and a single, non-redundant distribution path serving the critical environment.

The redundant components include generators, UPS modules and energy storage devices, chillers, heat rejection equipment, pumps, cooling units, and fuel tanks.

Tier III: Concurrently Maintainable Site Infrastructure

A Tier III data center has redundant capacity components and multiple independent distribution paths serving the critical environment. Only one distribution path is required to serve the critical environment at any one time (i.e., an active/backup configuration).

All IT equipment is dual-powered.

Every component can be removed from service on a planned basis without impacting any of the critical environment. There is sufficient capacity to meet the needs of the site when redundant components are removed from service.

Tier IV: Fault Tolerant Site Infrastructure

A Tier IV data center has multiple, independent, physically isolated systems that provide redundant capacity components and multiple, independent, diverse, active distribution paths simultaneously serving the critical environment (i.e., an active/active configuration).

All IT equipment is dual-powered.

A single failure of any component will not impact the critical environment. Every component can be removed from service on a planned basis without impacting any of the critical environment. There is sufficient capacity to meet the needs of the site when redundant components are removed from service on either a planned or an unplanned basis.

Data Center Site Infrastructure Tier Standard: Operational Sustainability

The business mission of any data center is to meet the availability and performance objectives of the organization while delivering satisfactory Return on Investment (ROI). The biggest barrier to achieving this mission is not the facility infrastructure. It is human error.

The Uptime Institute's Abnormal Incident Reports database reveals that the leading cause of reported data-center outages are directly attributable to shortfalls in management, staff activities, and operations procedures. However, all the blame does not lie with frontline operating teams. Upstream management decisions can either support reliability and efficiency, or they can set a data center on a path towards failure.

The Tier Standard for Operational Sustainability is a set of data-center facility management practices that help support the business objectives, independent of site infrastructure. Its focus is not on the design topology or infrastructure configuration but instead on the day-to-day decisions, practices, documentation, and team effectiveness.

The Uptime Institute's Tier Standard for Operational Sustainability is a recognized benchmark measuring risk mitigation. It encompasses all aspects of data center operation:

- Staffing and organization
- Maintenance
- Training
- Planning, coordination, and management
- Operating conditions

Operational Sustainability standards provide many benefits:

- Reduce downtime risk.
- Decrease cost to operate.

Enhance market confidence.
Ensure consistent quality across multiple sites.
Increase labor efficiency.
Achieve greater return on capital investment.

The Tier Standard for Operational Sustainability is detailed in the Uptime Institute's document entitled "Data Center Site Infrastructure Tier Standard: Operational Sustainability." The three elements of Operational Sustainability are (in order of importance):

Management and operations
Building characteristics
Site location

The standard organizes dozens of data-center activities associated with these three elements into several categories and indicates which activities are applicable to which topology tiers (Tiers I through IV). The categories are:

Management and Operations:
Staffing and Organization
Maintenance
Training
Planning, Coordination, and Management
Operating Conditions
Pre-Operational
Building Characteristics:
Building Features
Infrastructure
Site Location:
Natural Disaster Risk
Man-Made Disaster Risk

The Uptime Institute awards three levels of Operational Sustainability:

Gold: The full uptime potential of the installed infrastructure is realized or exceeded.

Silver: There are opportunities for improvement in order to achieve the full potential of the installed infrastructure.

Bronze: There are significant opportunities in order to achieve the full potential of the installed infrastructure.

The Operational Sustainability award becomes a suffix for the Tier award – e.g., Tier III Silver.

Summary

The uptime of a data center is the resultant combination of both the Tier of the site infrastructure and the level of Operational Sustainability.

The Uptime Institute provides two credentials that validate a data center's management and operations best practices:

- Tier Certification of Operational Sustainability (TCOS) for organizations that are on a Tier Certification Track.

- Management and Operations (M&O) Stamp of Approval for existing data centers that were not built for or do not have the Tier Certification (independent of infrastructure topology).

Acknowledgements

Material for this article was taken from the following sources:

Uptime Institute, *Wikipedia*.

Sustaining Operational Effectiveness for the Long Term, *Uptime Institute*.

Data Center Site Infrastructure Tier Standard: Topology, *Uptime Institute*.

Data Center Site Infrastructure Tier Standard: Operational Sustainability, *Uptime Institute*.