

AVAILABILITY AND SUSTAINABILITY OF OPERATIONS IN DATA CENTERS



INFOBATT 2011

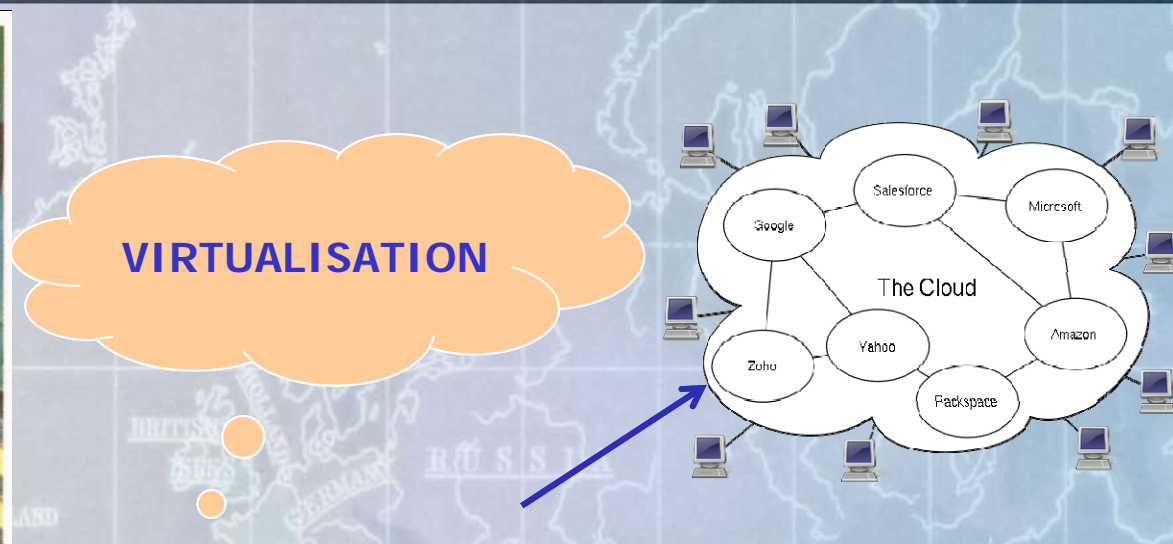
*By:
Kamil Khoukaz – ATS
STANEX Inc*



- Data Center Infrastructure: Definitions**
- Uptime Institute and Tier Classifications**
- Operational Sustainability Standard established by Uptime Institute**
- Before choosing the adequate power system**
- UPS Selection Criterias**

Between yesterday and Today

Stanex



❖ Data Center:



- Facility used for housing computers and communications equipments including power supplies, air conditioning and security application.

❖ Availability/Uptime:

- Period of time when the computer is operational and available for use

❖ Reliability:

- Probability that a system or component will perform under normal operating conditions for a set of time.

❖ Infrastructure:

- The electrical, mechanical, and structural system that make up a Data Center

DEFINITIONS

❖ Topology:

- Physical configuration of the infrastructure

❖ Outage:

- Outage is loss of IT equipment

❖ « N »:

- Required number of units (Components) necessary to meet capacity of system

❖ « R »:

- Number of redundant components

The UPTIME INSTITUTE is a non-profit organization that focuses on the questions of high availability and performance in data centers. This group, known worldwide, has established 4 levels of fault tolerance in data centers. These levels are called «Tiers». There are 4 levels: Tier I to Tier IV.

In addition to the above, Uptime Institute has established a certification standard related to the Operation Sustainability in a Data Center. There are three levels: Bronze, Silver and gold.



❖ Objectives:

- *Provide a common understanding and language of data center infrastructure concepts*
- *Identify expected Data Center performance by differences in topology: Recognize that all Data centers are not alike*
- *Uptime Institute Tier Standard is voluntary: No conflict with codes and regulations*

❖ Concepts:

- *Redundant capacity components*
- *Redundant distribution paths*
- *Classification based on Maintenance Opportunity and Failure Response*
- *Fractional concepts are not recognized: No standard for Tier III + or Tier II.5 (Rating tied to lowest system)*

Uptime Institute Certifications are delivered exclusively by Uptime Institute Tier Certification Authorities

TIER I: Basic capacity

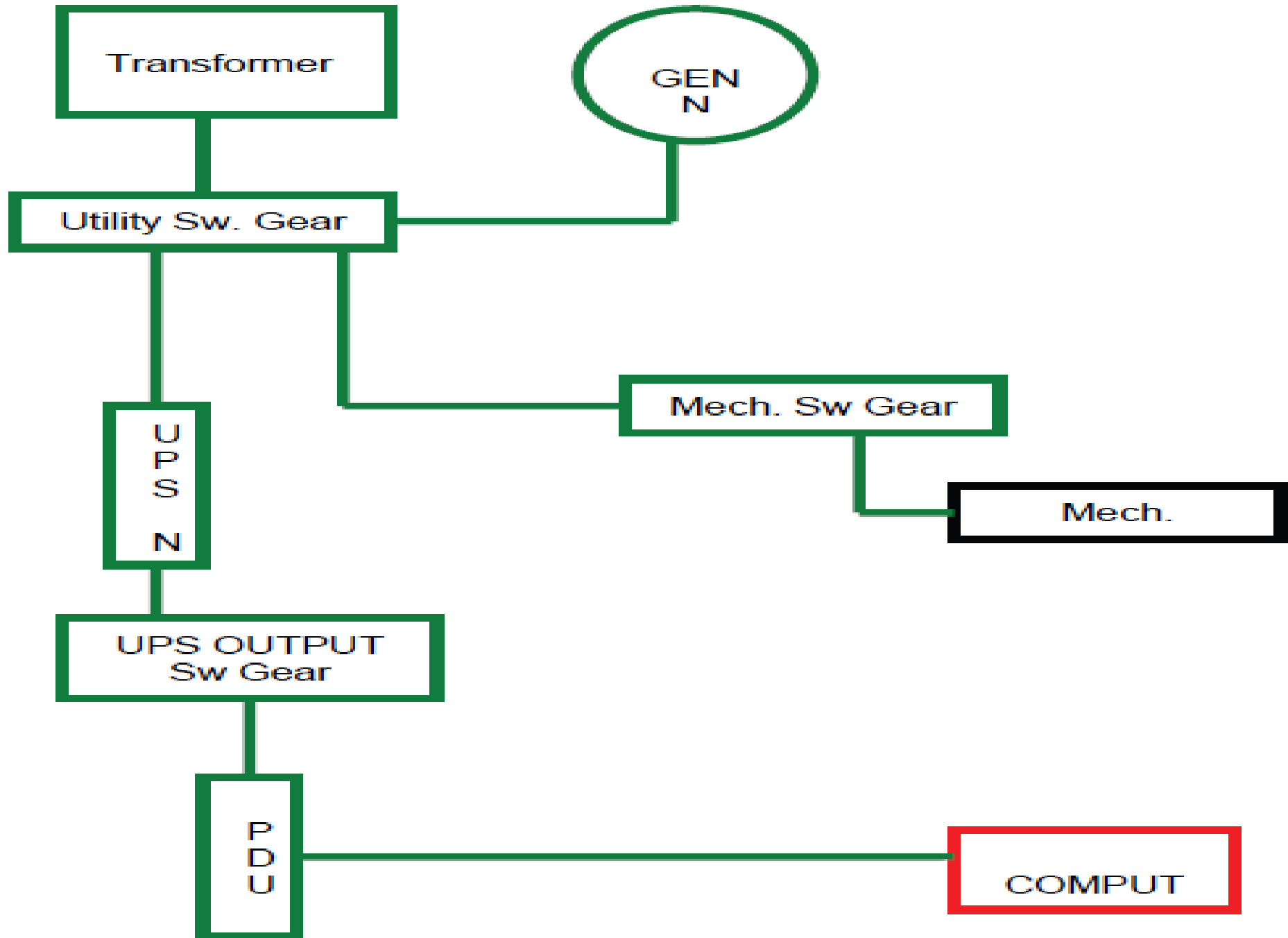
❖ Summary:

- *Space, Power and cooling Systems allocated for Critical Environment*
- *Non-redundant capacity components (“N” only)*
- *Single distribution path*

❖ Operations and Maintenance Considerations:

- *For annual maintenance and repair works, the site infrastructure and the IT equipment must be shutdown.*
- *Installation or replacement of new components may disrupt the Critical Environment*

TIER I: Basic capacity



TIER II: Redundant Components

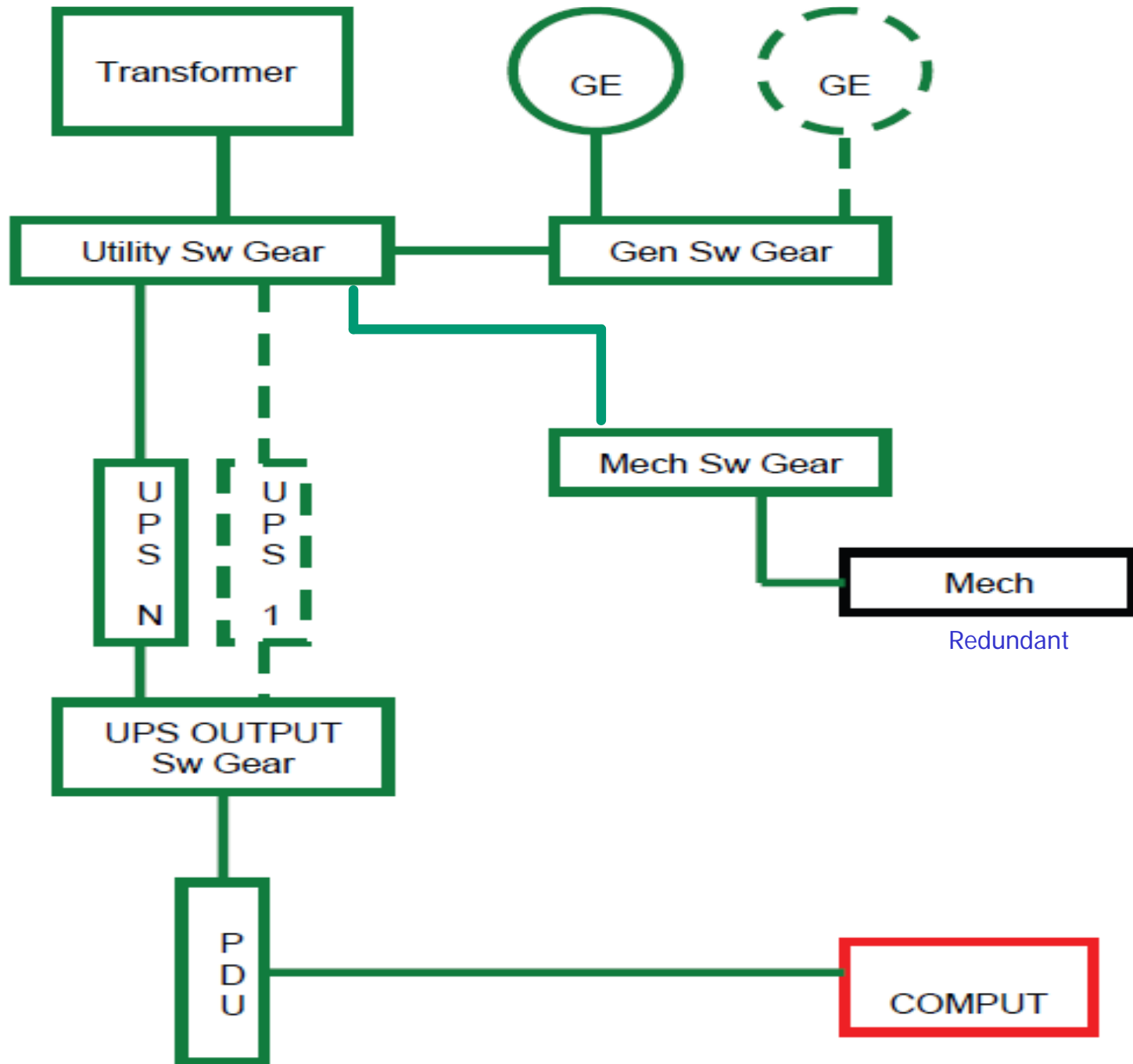
❖ Summary:

- **Redundant capacity components (N+R):**
 - ✓ **Engine generators, UPS modules, IT and cooling**
- **Single distribution path**

❖ Operations and Maintenance Considerations:

- **Some capacity components can be maintained or repaired without having impact on the IT equipment.**
- **For annual maintenance and repair works, the site infrastructure and the IT equipment must be shutdown.**
- **Installation or replacement of new components may disrupt the Critical Environment**

TIER II: Redundant Components



TIER III: Concurrently Maintainable



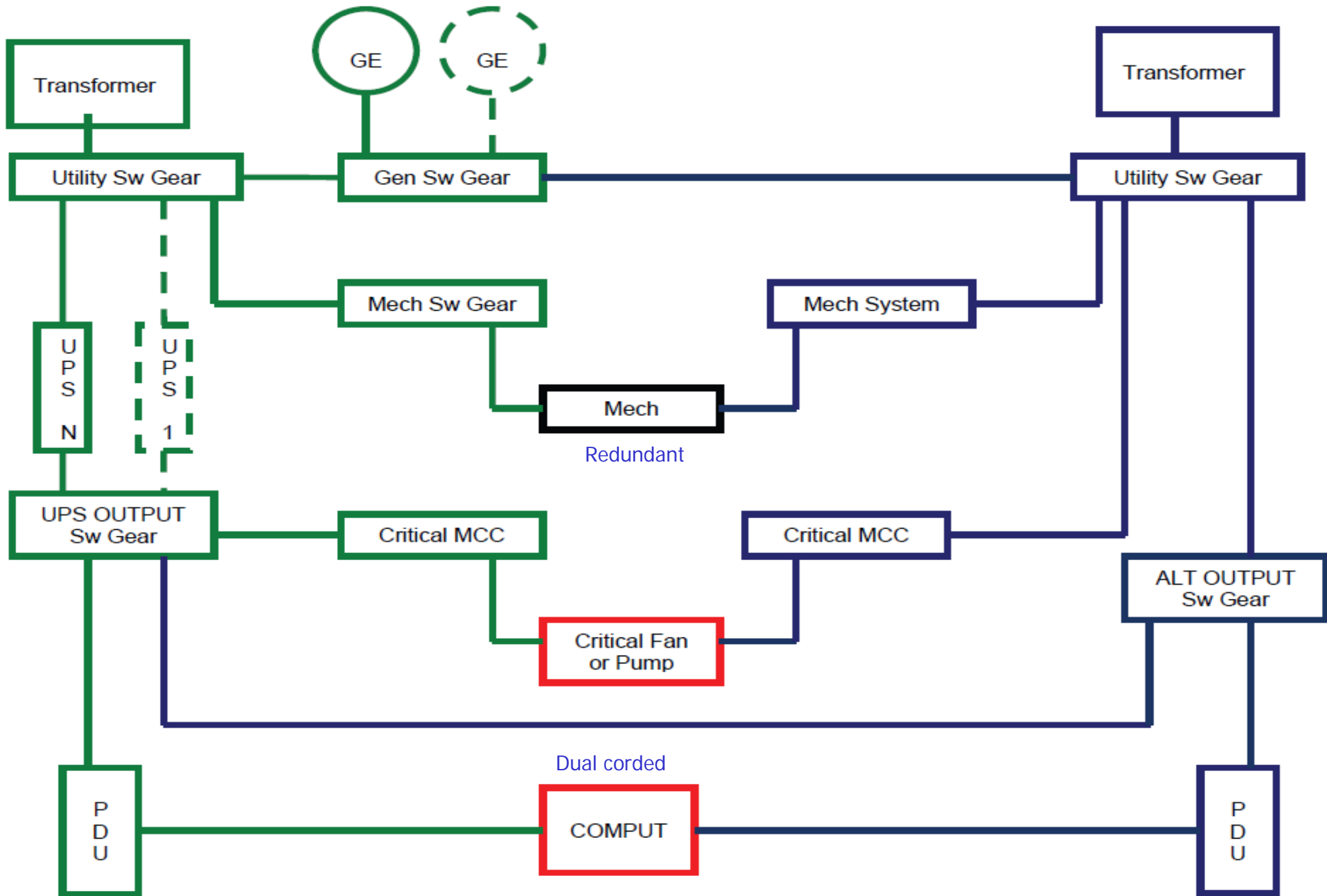
❖ Summary:

- *Redundant capacity components and independent distribution paths*
- *Only one distribution path is active at a time*
- *Dual corded IT equipment*
- *No runtime limits on engine-generator capacity*

❖ Operations and Maintenance Considerations:

- ***Each and Every** capacity component and distribution path element can be taken out of service for planned maintenance, repair, or replacement without impacting the **Critical Environment or IT processes***

TIER III: Concurrently Maintainable



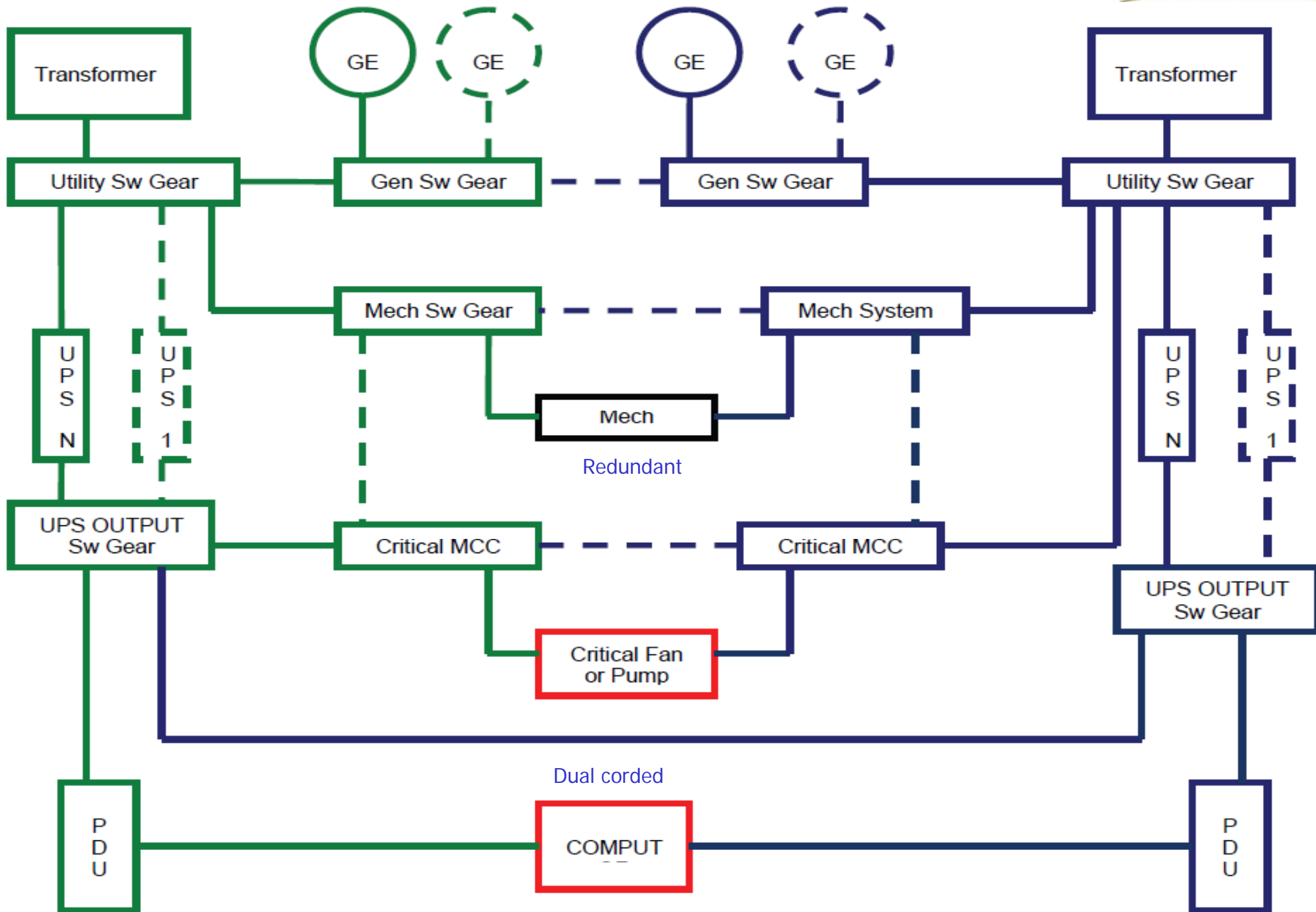
❖ Summary:

- *Redundant components*
- *Two distribution paths. Both*
- *Physically isolated components (Compartmentalization)*
- *Continuous cooling for critical IT and UPS systems*
- *Autonomous response (N after any failure)*
- *No runtime limits on engine-generator capacity*

❖ Operations and Maintenance Considerations:

- ***Each and Every** component and distribution path element can sustain a failure and planned or unplanned maintenance activity or repair works without having an impact on the IT equipments and the operation of the Data Center.*

TIER IV: Fault Tolerant

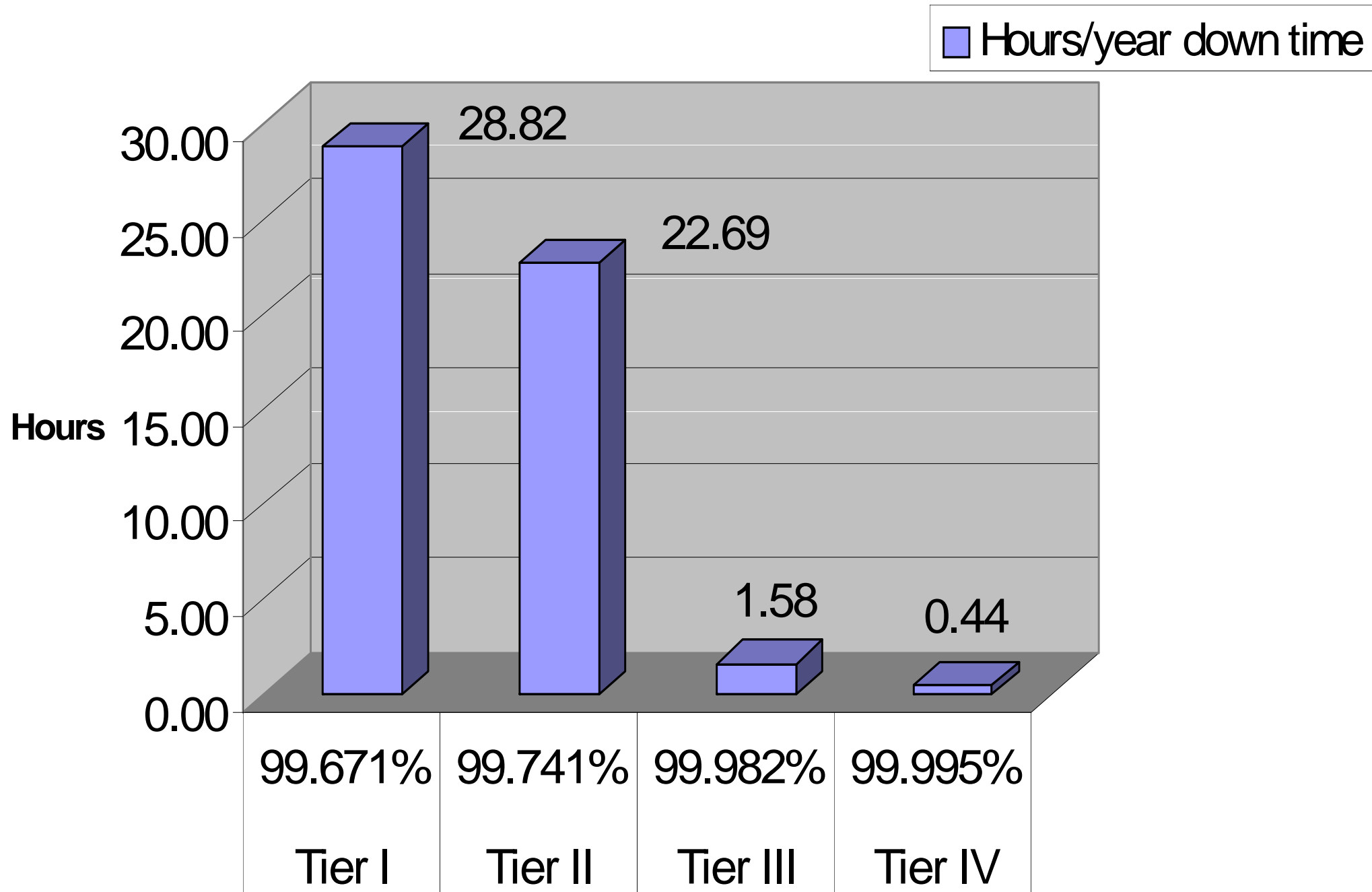


In Summary

Tier requirement	Tier I	Tier II	Tier III	Tier IV
Source	System	System	System	System + System
System component redundancy	N	N+1	N+1	Min N+1
Distribution paths	1	1	1 normal + 1 alternate	2 simultaneous
Compartmentalization	No	No	No	Yes
Concurrently maintainable	No	No	Yes	Yes
Fault tolerant	No	No	No	Yes

Source:
Uptime Institute

Tier I - IV Data Center Design



❖ Definition (By Uptime Institute)

- *“The behaviors and risks beyond Design Topology that impact the ability of a Data Center to meet its Business Objectives over the long term”.*

“Of all outages, 70% are caused by human error”

❖ Purpose of the standard:

- *Document the Operational Sustainability behaviors and risks*
- *Focus on those items that will most improve the performance of a data center*

Operations sustainability ratings or certifications are delivered exclusively by Uptime Institute Authorities

Management and Operations

Building Characteristics

Site Location

**Main element which can change over time is:
Management & Operations**

Staffing & organization:

- Staffing presence
- Qualifications
- Organization

Training:

- Data Center Staff training
- Vendor training

Maintenance:

- PM Program
- Housekeeping
- MMS
- Vendor Support

Planning & Coordination:

- Site Policies
- Reference Library

Building Features:

- Support Spaces
- Security and Access
- Topology Enhancements

Operating Conditions:

- Operating Set Points

Infrastructure:

- Flexibility for Capacity Increases
- Ease of maintenance

Pre-operational:

- Commissioning

Natural Disasters:

- Flooding
- Hurricanes, Tornadoes
- Volcano
- Earthquakes

Man-made Disasters:

- Airports
- Transportation Corridors

- Need Design and Facility Tier Topology Certification First:
 - I, II, III or IV
- Operational Sustainability Certification based on Tier Certification:
 - Bronze, Silver, Gold
- Operational Sustainability Certification becomes suffix to Tier certification:
 - Tier III Gold

Operations sustainability ratings or certifications are delivered exclusively by Uptime Institute Authorities

Source:
Uptime Institute

Operation Sustainability Certification

(as established by Uptime Institute)

GOLD

- Exceptional management and Operation behaviors
- Low Site location risks
- Full uptime potential of the installed infrastructure realized

SILVER

- Evident Management & Operation behaviours
- Low Site location risks
- Opportunities for improvement in order to achieve full potential of the installed infrastructure

BRONZE

- Minimal Management & Operations behaviours
- Documented Site Location risks
- Significant opportunities for improvement in order to achieve the full potential of the installed infrastructure

Operations sustainability ratings or certifications are delivered exclusively by Uptime Institute Authorities

*Source:
Uptime Institute*

Questions to ask before choosing the adequate Power System

1. What level of Availability is the power system expected to have
2. What is the Lifetime Cost of the Power System
3. What is the impact of the Power System on Data Center Space
4. How will the Power System be Tested and Installed
5. How will the Power System be Monitored and Maintained
6. Is the system ready for Future Possible Expansion
7. What is the Impact on the Environment

1. Availability

- Tier Level
- System Configuration
- Real redundancy

2. Efficiency

3. Reliability

- MTBF
- MTTR
- Choice of batteries
- Testing in the factory and on site

4. Modularity

4. Monitoring

Predictive Analysis
Fast response

5. Service

Technical Assistance
Qualification of Technicians
Availability of Spare parts
Replacement of lifetime limited components

Conclusion

The goal of any power system is to achieve the appropriate levels of quality and system availability as simply and cost effectively as possible.

THANK YOU

Stanex

Kamil Khoukaz