UPTIME Institute Guidelines Summary

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Life Is On Schneider Electric

Availability

Uptime Institute Data Centre Site Infrastructure Tier Standard Classification method widely referenced in data center construction industry

Four Tier Levels (Revision 5)

- Tier I – **Basic** Data Center Site Infrastructure
- Tier II – **Redundant** Site Infrastructure Capacity Components
- Tier III – **Concurrently Maintainable** Site Infrastructure
- Tier IV – **Fault Tolerant** Site Infrastructure

All tiering assessment builds on the previous tier level.

Final tier assessed is progressively and is based on the weakest point of overall design considering both power and cooling.

Availability

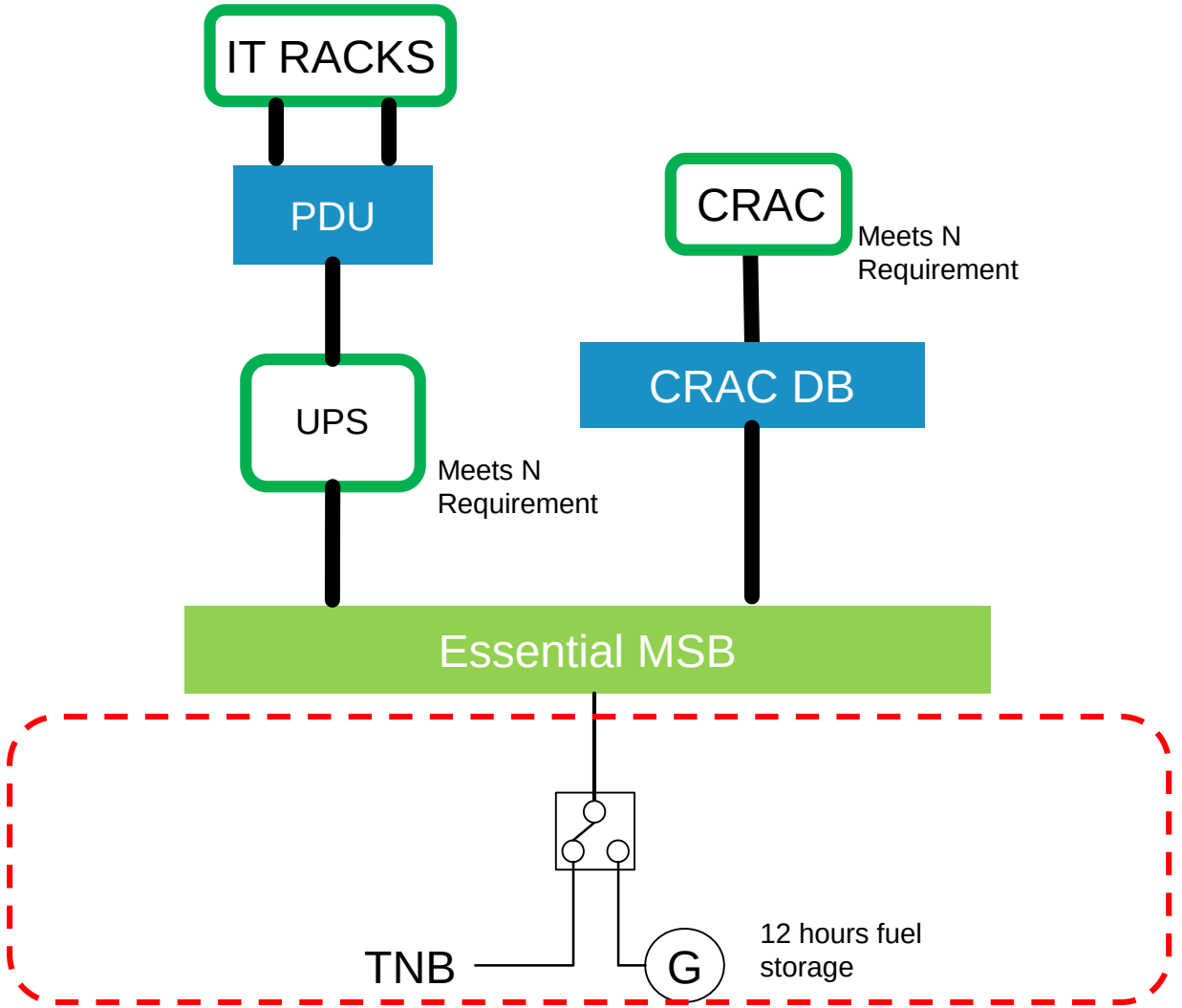
Criticality	Business characteristics	Effect of system design
1. (Lowest)	•Typically small businesses •Mostly cash-based •Limited online presence •Low dependence on IT •Perceive downtime as a tolerable inconvenience	•Numerous single points of failure in all aspects of design •No generator if UPS has 8 minutes of backup time •Extremely vulnerable to inclement weather conditions •Generally unable to sustain more than a 10 minute power outage
2.	•Some amount of online revenue generation •Multiple servers •Phone system vital to business •Dependent on email •Some tolerance to scheduled downtime	•Some redundancy in power and cooling systems •Generator backup •Able to sustain 24 hour power outage •Minimal thought to site selection •Vapor barrier •Formal data room separate from other areas
3.	•World-wide presence •Majority of revenue from online business •VoIP phone system •High dependence on IT •High cost of downtime •Highly recognized brand	•Two utility paths (active and passive) •Redundant power and cooling systems •Redundant service providers •Able to sustain 72-hour power outage •Careful site selection planning •One-hour fire rating •Allows for concurrent maintenance
4. (Highest)	•Multi-million dollar business •Majority of revenues from electronic transactions •Business model entirely dependent on IT •Extremely high cost of downtime	•Two independent utility paths •2N power and cooling systems •Able to sustain 96 hour power outage •Stringent site selection criteria •Minimum two-hour fire rating •High level of physical security •24/7 onsite maintenance staff

Tier I Requirements

Tier I Fundamental Requirements

- Non-redundant capacity components.
- Single non-dedicated power distribution path.
- 12 hours of on-site fuel for Generator Set (GENSET).
- Dedicated space for IT
- UPS to filter out power quality issues and accommodate TNB and Genset.
- Dedicated cooling equipment.
- On-Site power production (GENSET).

Tier I Requirements (Example)

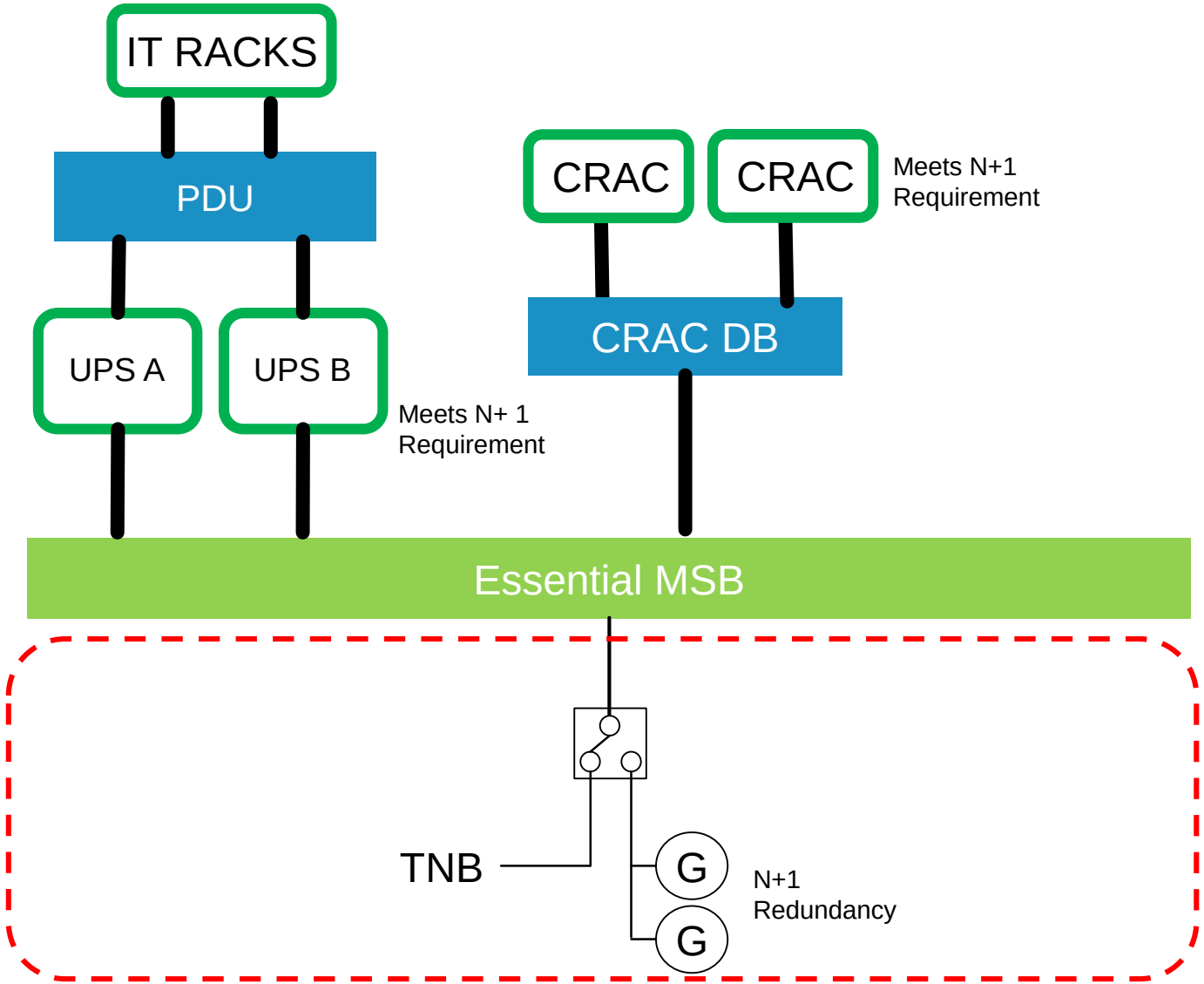


Tier II Requirements

Tier II Fundamental Requirements

- Redundant capacity **components** and a single at least N+1.
- Single non-dedicated power distribution path.
- 12 hours of on-site fuel for Generator Set (GENSET) for N capacity.
- Dedicated space for IT
- UPS to filter out power quality issues and accommodate TNB and Genset.
- Dedicated cooling equipment.
- On-Site power production (GENSET).

Tier II Requirements (Example)

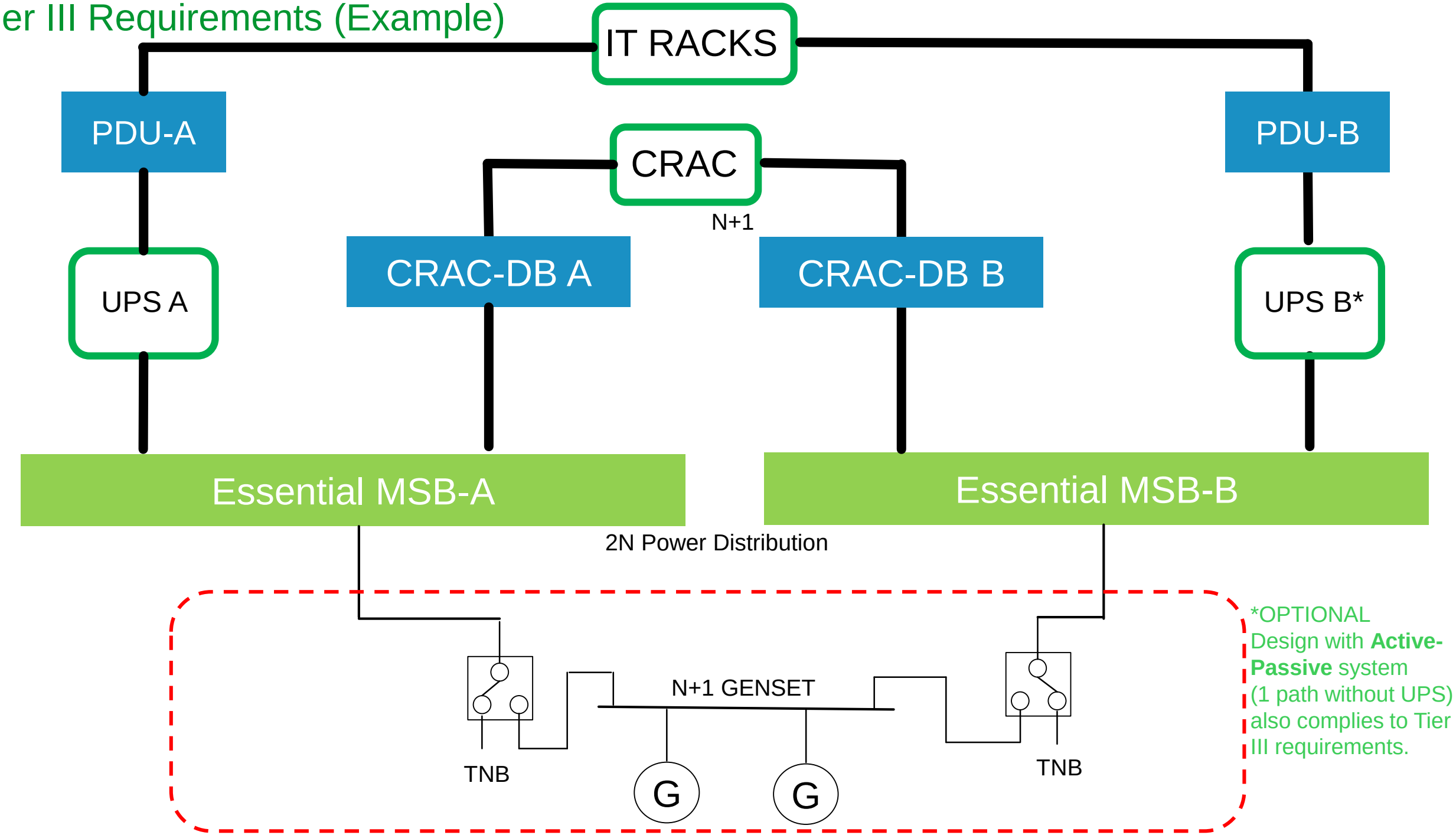


Tier III Requirements

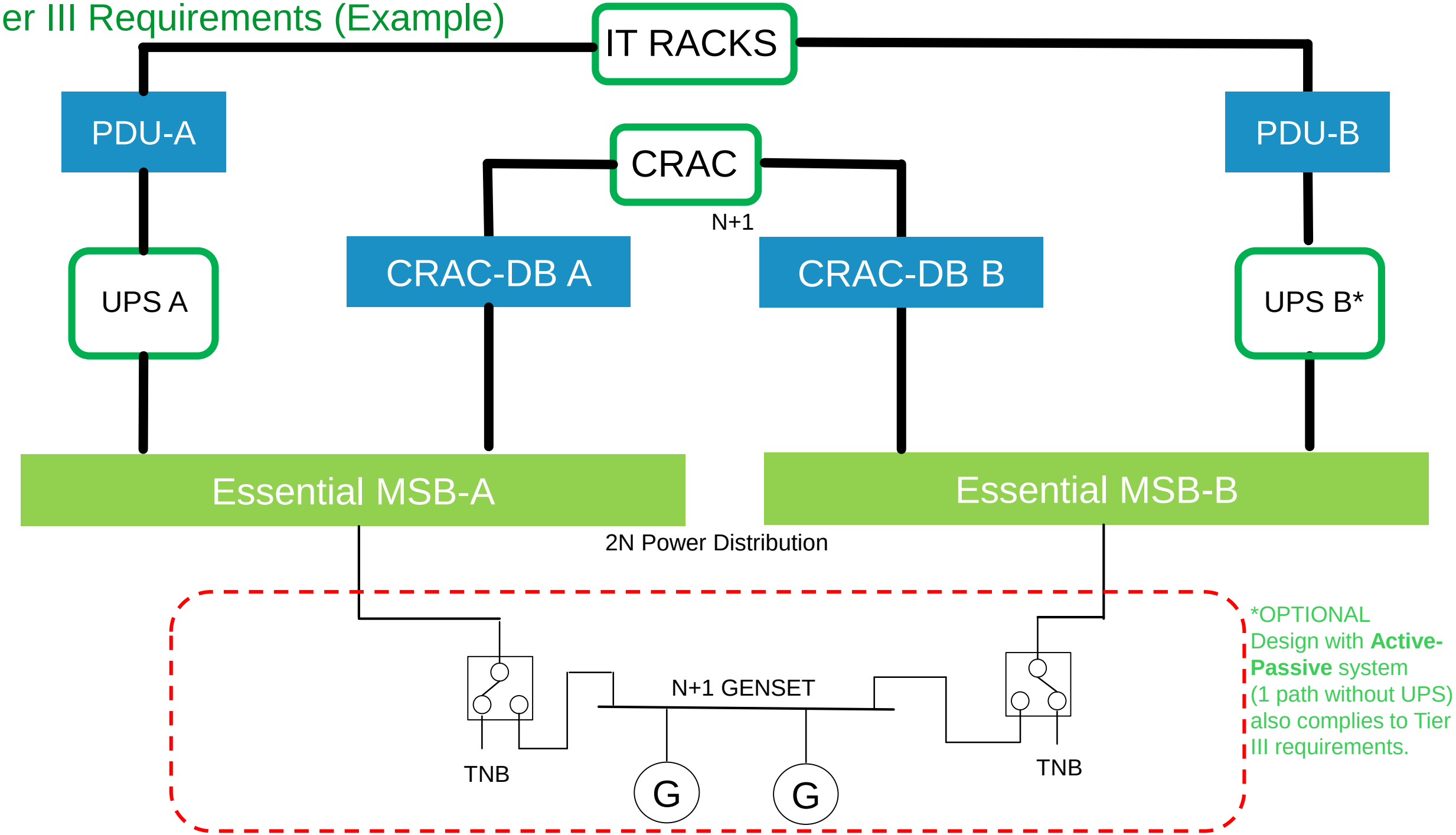
Tier III Fundamental Requirements

- **Concurrent Maintainable** data centre that has **redundant capacity** and **multiple independent distribution paths.**
- Minimum two power distribution paths. Minimum **one active** path.
- **Each and every** component can be removed (planned) from service without impact to the critical load.
- Every IT equipment is dual powered or equipped with point-of-use power switches.
- 12 hours of on-site fuel for Generator Set (GENSET) for N capacity.
- Dedicated space for IT
- UPS to filter out power quality issues and accommodate TNB and Genset.
- Dedicated cooling equipment meeting N+1 requirement.
- On-Site dedicated power production (GENSET). Utility power (TNB) is not recognized as a power source. Reliable and automatic transfer between TNB and GENSET is required.

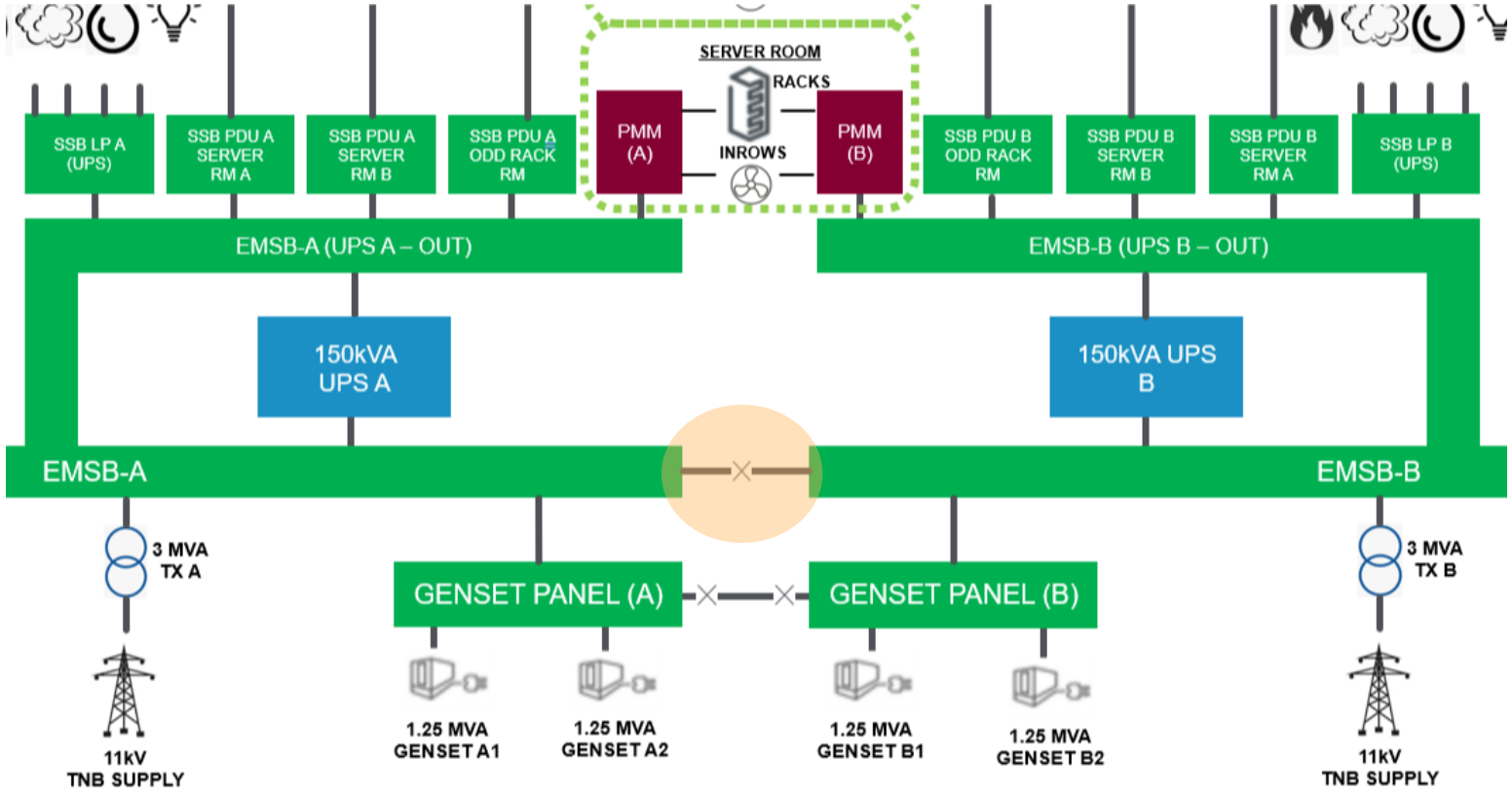
Tier III Requirements (Example)

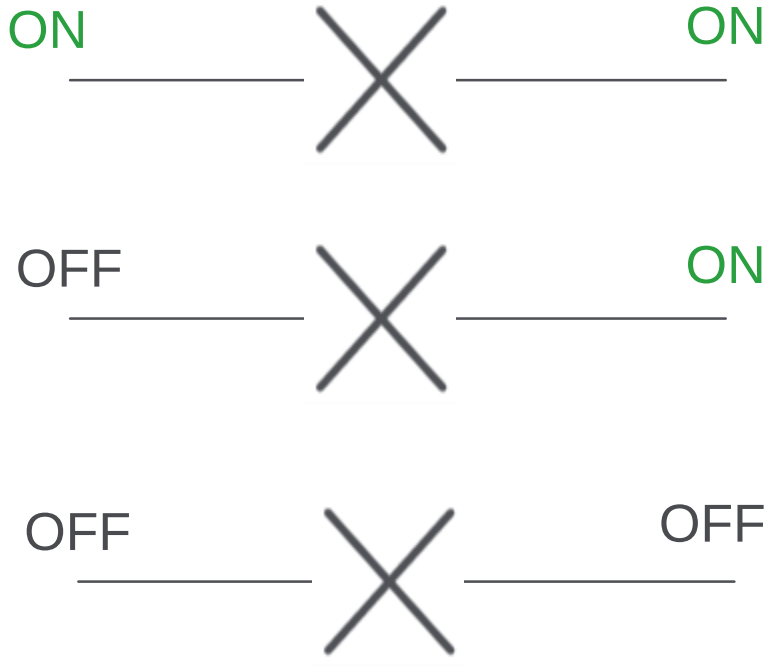


Tier III Requirements (Example)



Main-Tie-Main





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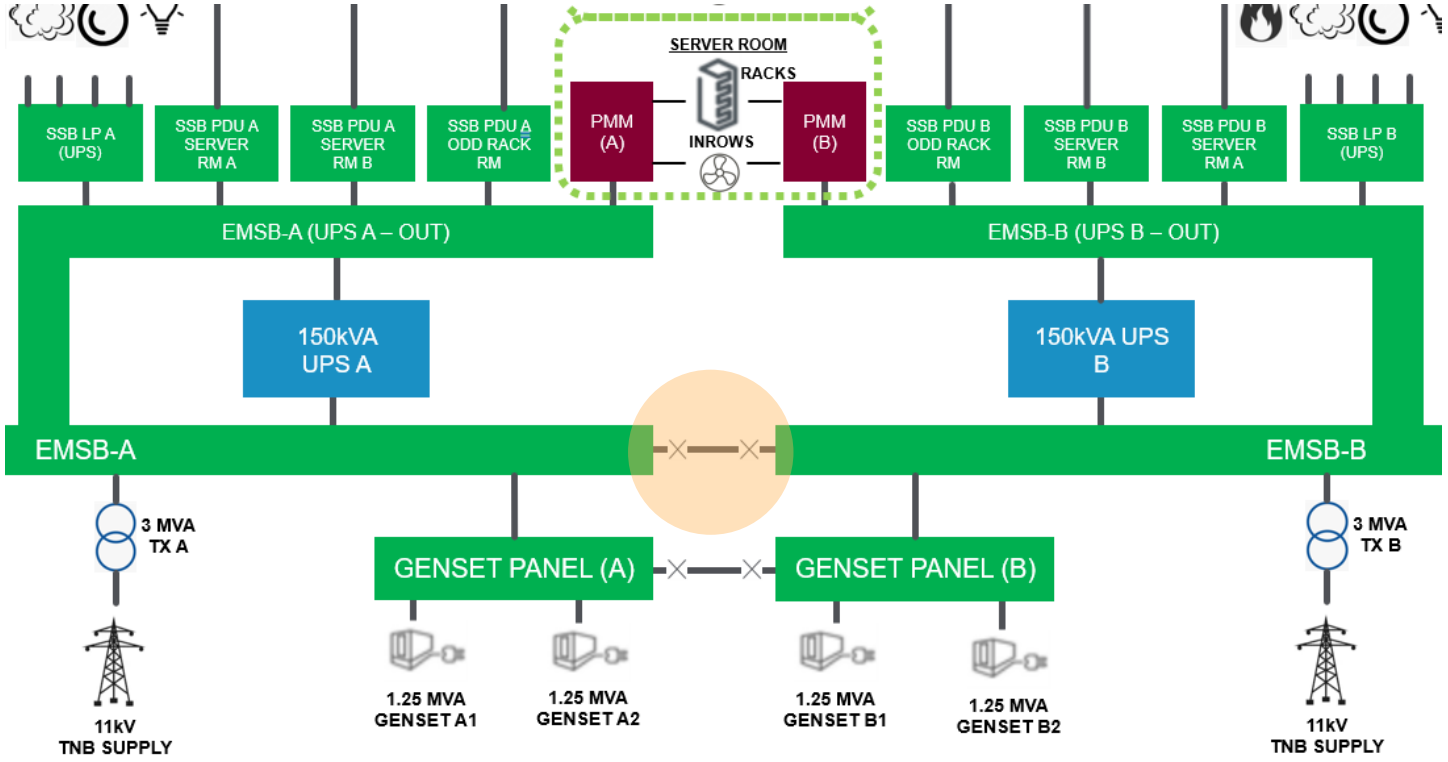
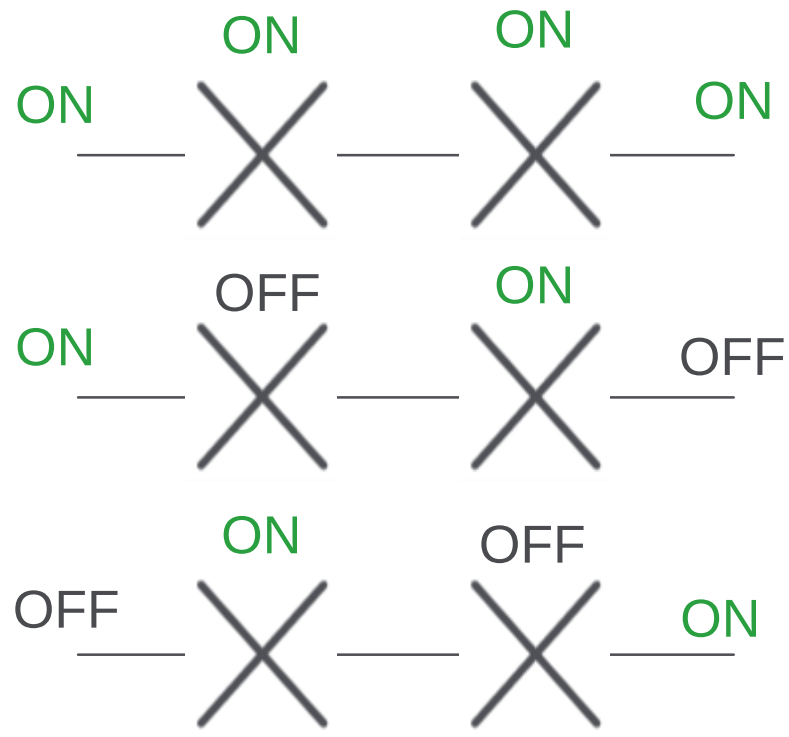
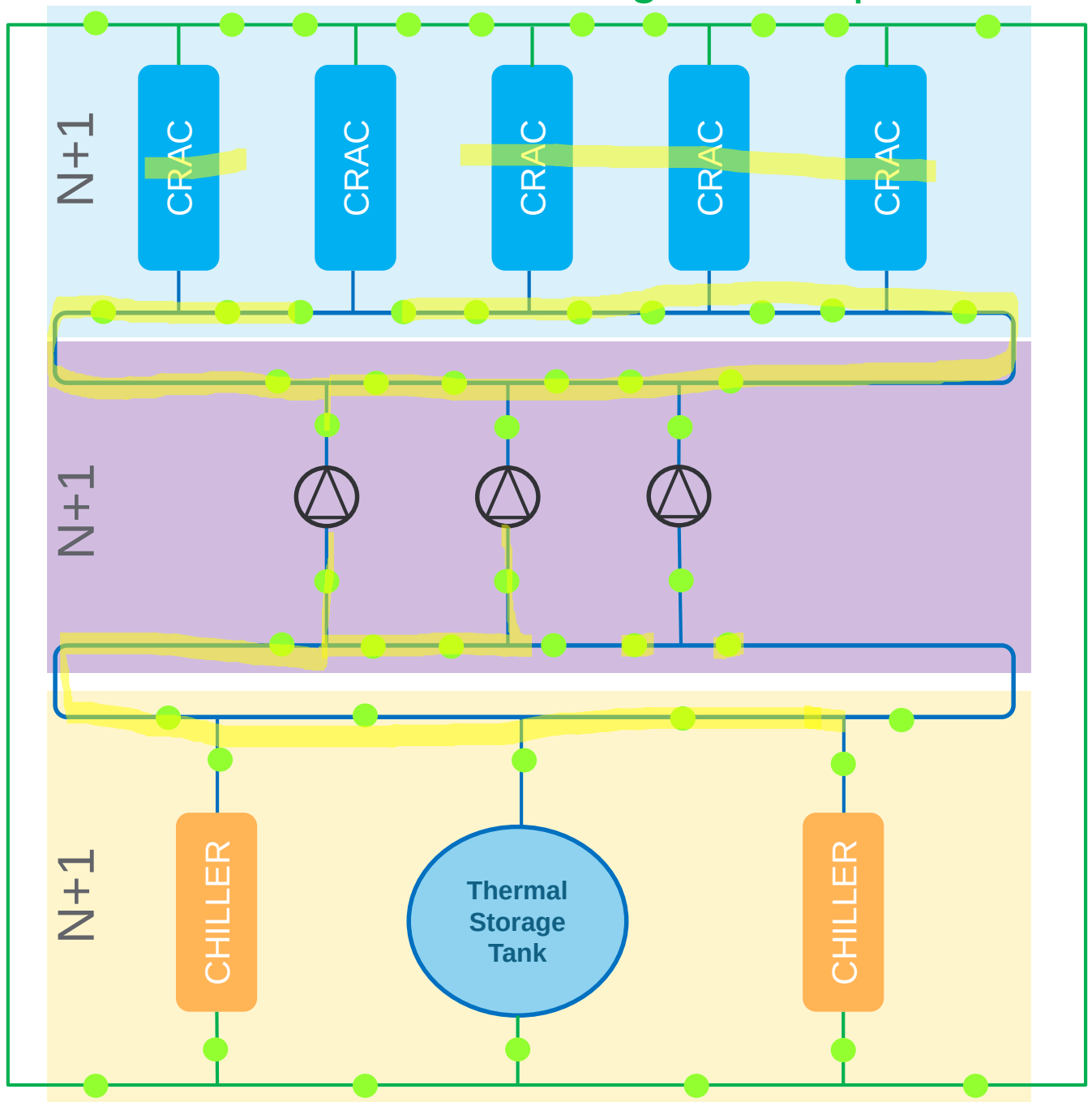




Overall Chilled Water Design Concept



Legend

- Chilled Water Pumps
- Isolation Valves
- Chilled Water Supply
- Chilled Water Return

Tier III Design:

> Redundant Components

> Concurrent Maintainable

Proposed Design:

> Each pod InRow with N+1 redundancy

> Pump designed with N+1 redundancy

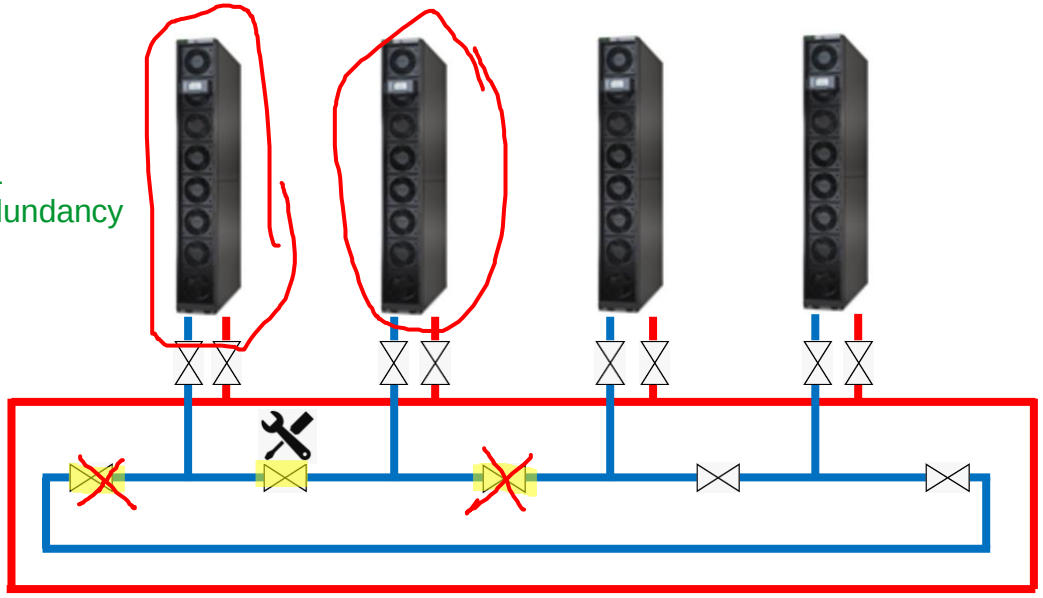
> Chillers designed with N+1 redundancy

> Chilled water pipe follows ring circuit design for dual distribution path (concurrent maintainability)

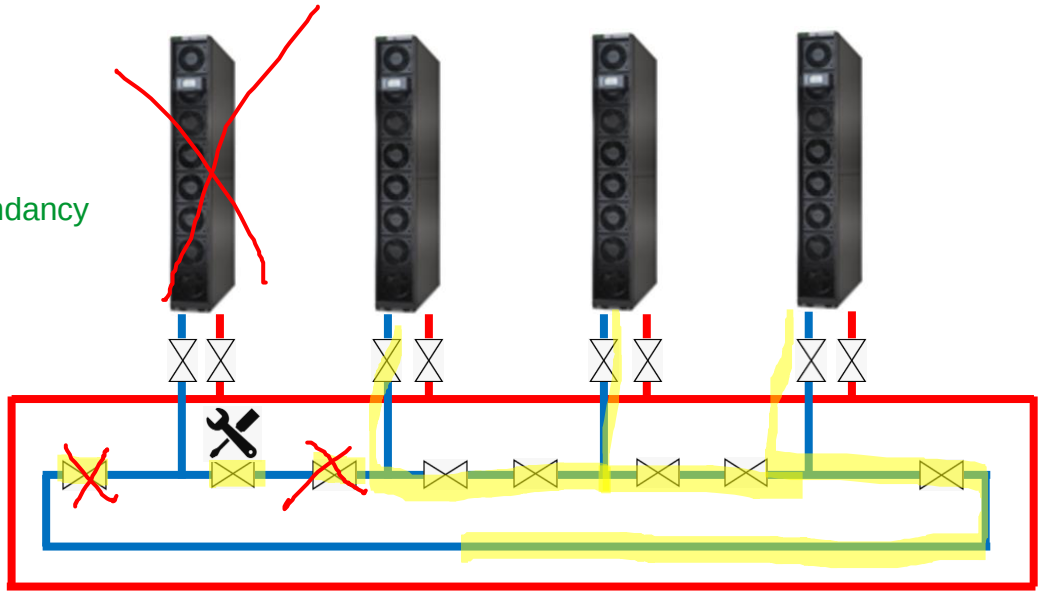
> Valve placement for concurrent maintainability

Overall Chilled Water Design Concept

N+1
Redundancy



N+1
Redundancy



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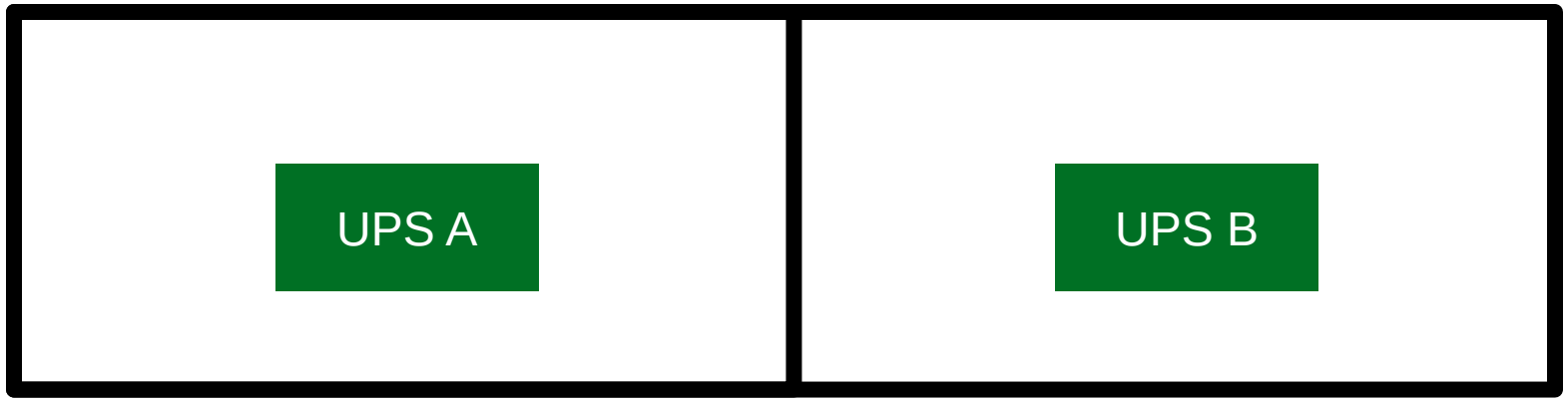
Tier IV Requirements

Tier II Fundamental Requirements

- **Fault Tolerant** data centre that has **multiple, independent, physically isolated systems** that provide **redundant capacity components.**
- Not susceptible to disruption from a single planed/unplanned event.
- **Compartmentalization - Complementary systems and distribution paths** that are **physically isolated from each other.**
- **Continuous cooling** is required as per ASHRAE requirements.
- Every IT equipment is dual powered or equipped with point-of-use power switches.
- 12 hours of on-site fuel for Generator Set (GENSET) for N capacity.
- Dedicated space for IT
- UPS to filter out power quality issues and accommodate TNB and Genset.
- Dedicated cooling equipment.
- On-Site power production (GENSET). TNB is not recognized as a power source. Reliable and automatic transfer between TNB and GENSET is required.

Compartmentalization

- Applies to complementary systems and distribution paths in Tier IV topology.
- Tier IV **requires** physical isolation to prevent a **single event** from simultaneously impacting more than the number of redundant components or systems
- Each component shall contain **no more than the number of redundant components**.



Redundancy
N+1

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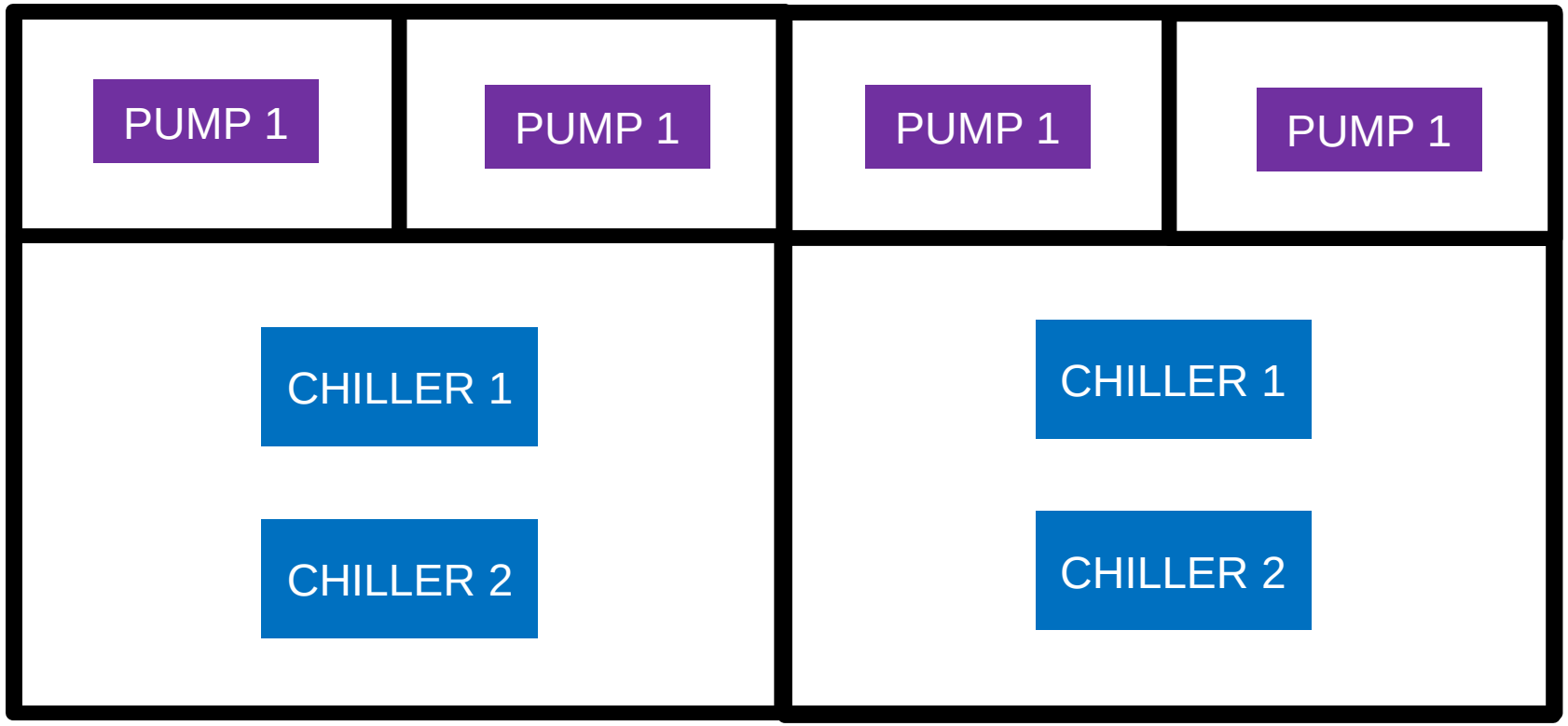

Pump Redundancy
N+1

Chiller Redundancy
N+2

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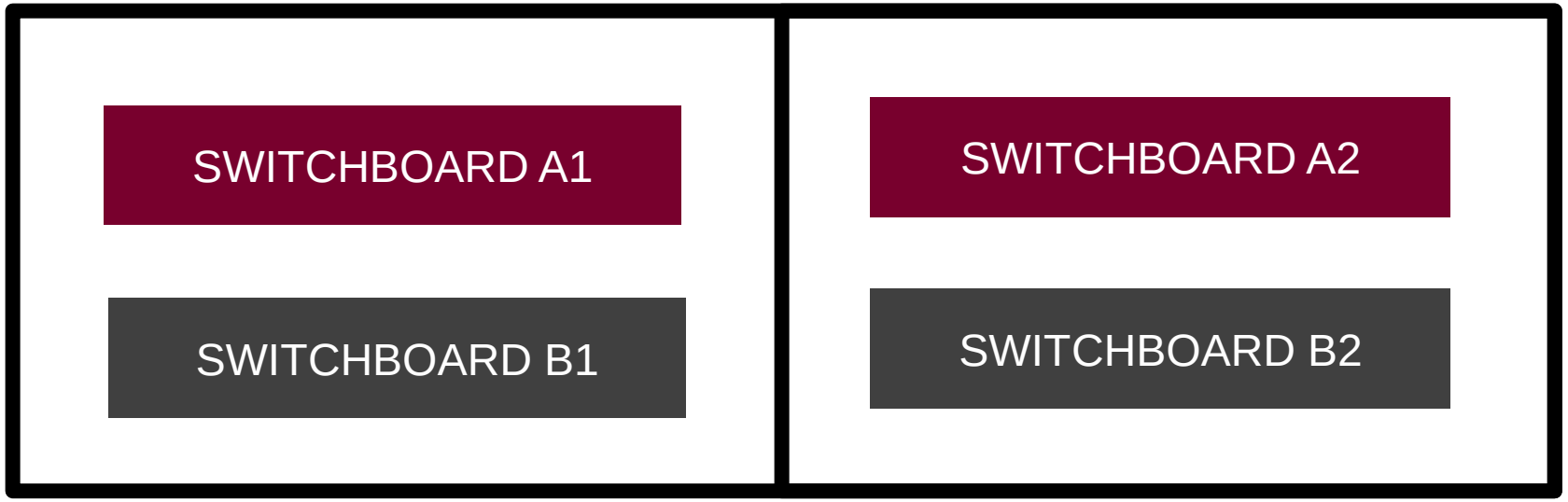

Electrical Redundancy
2N

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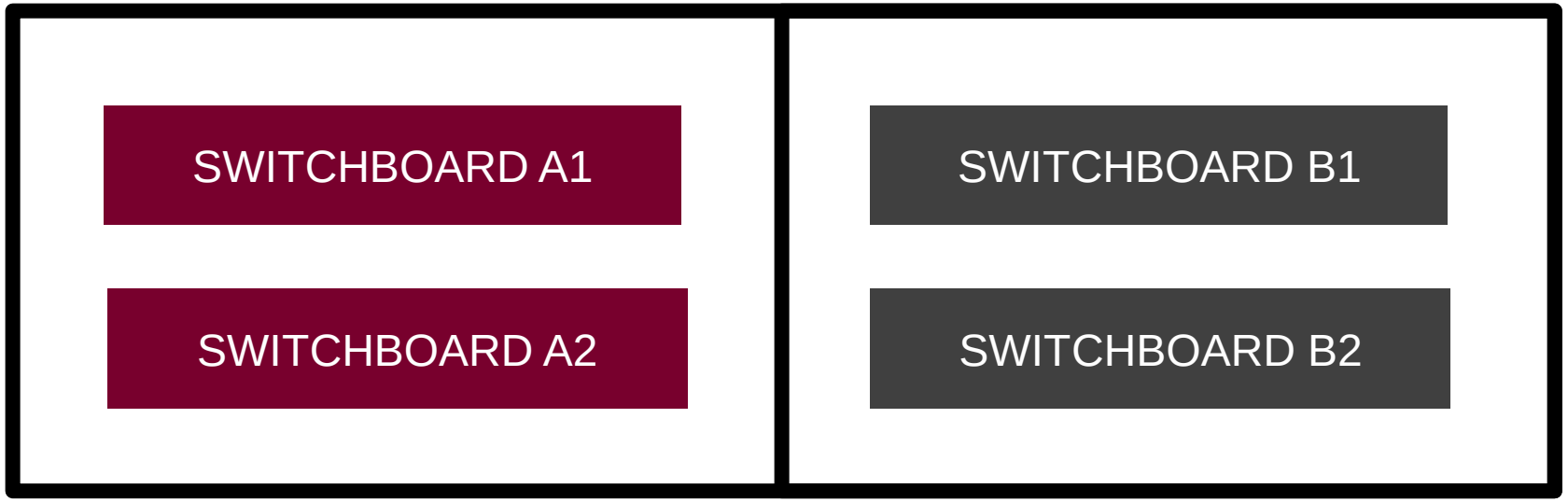

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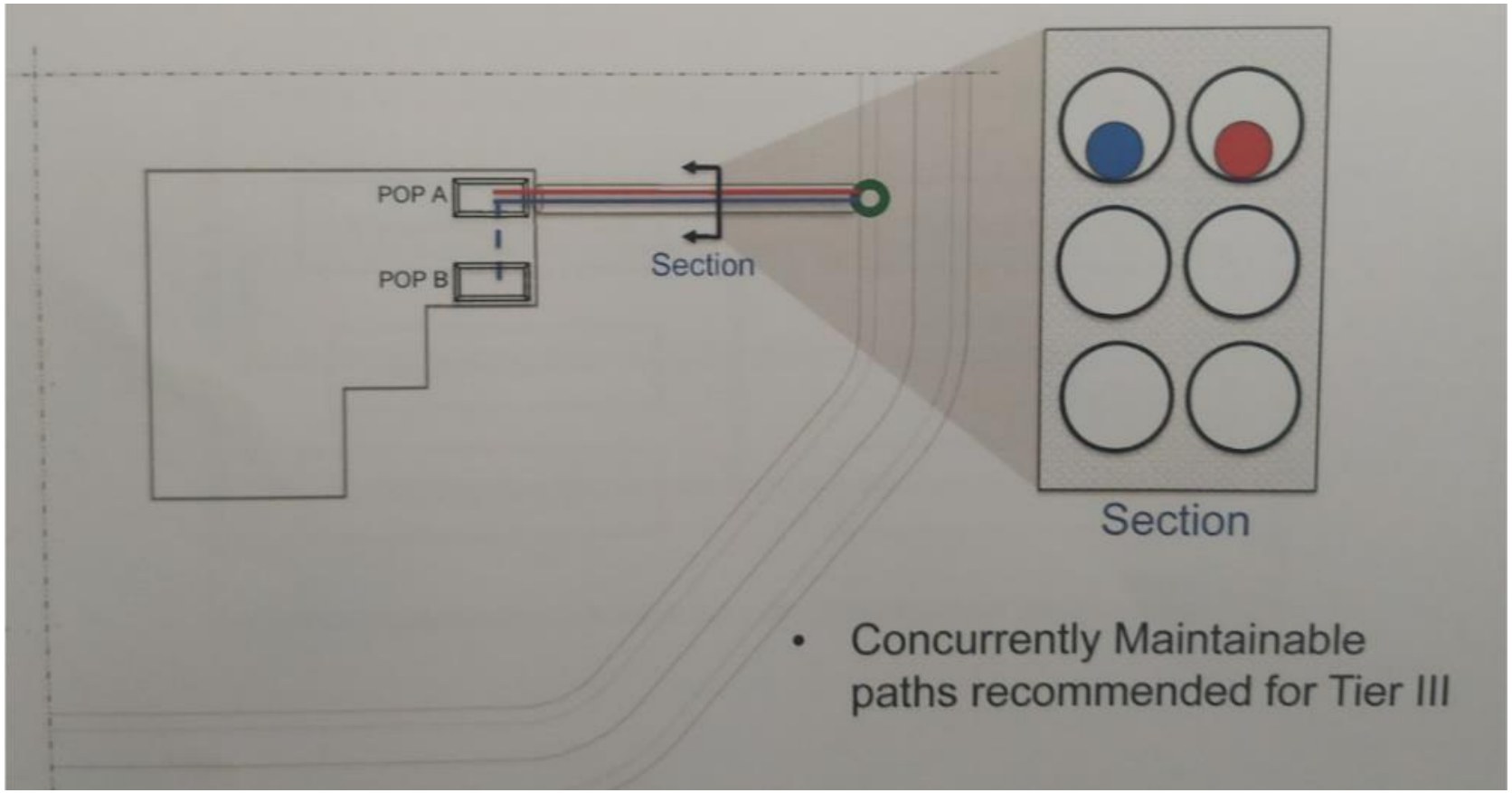

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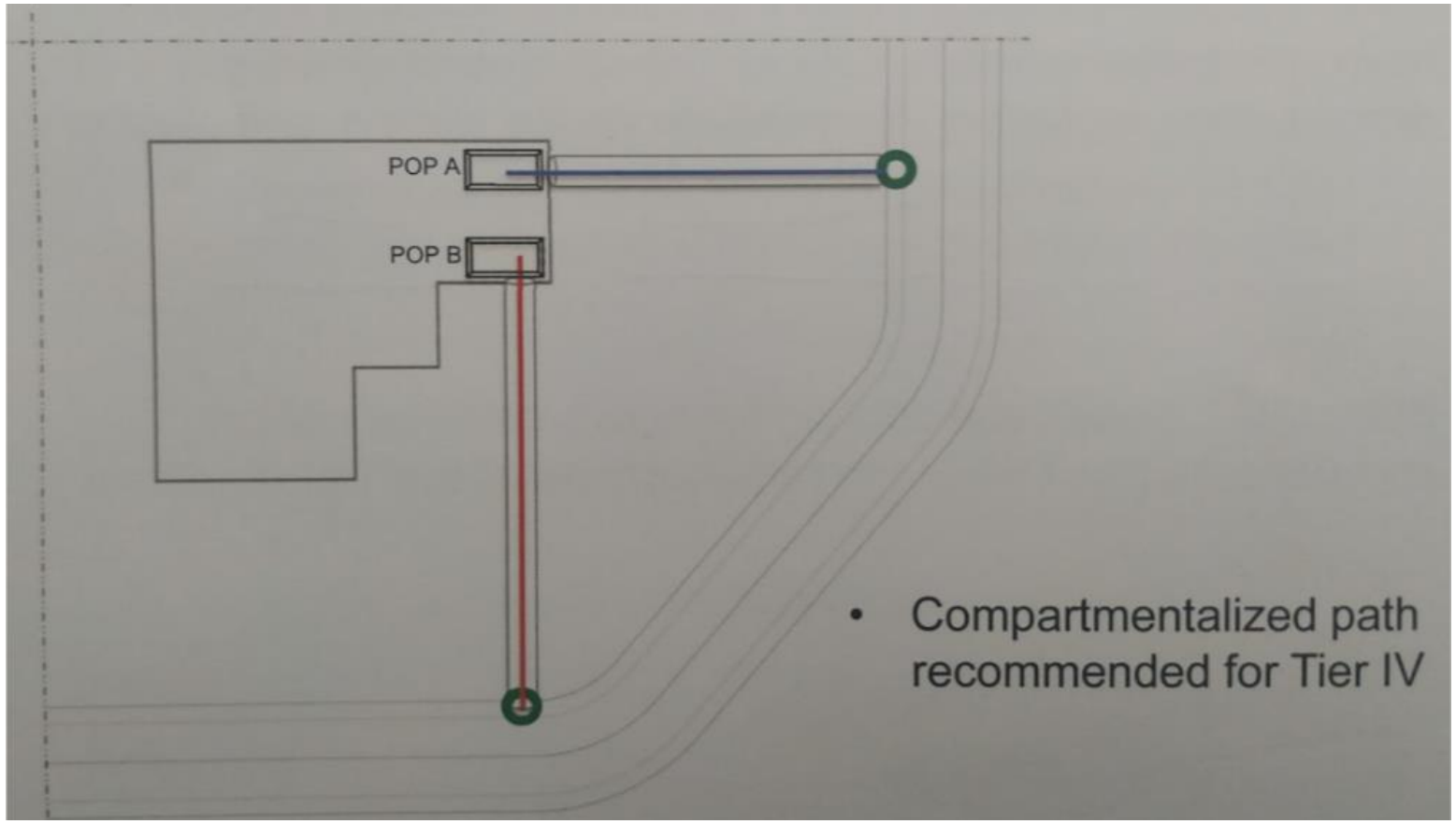

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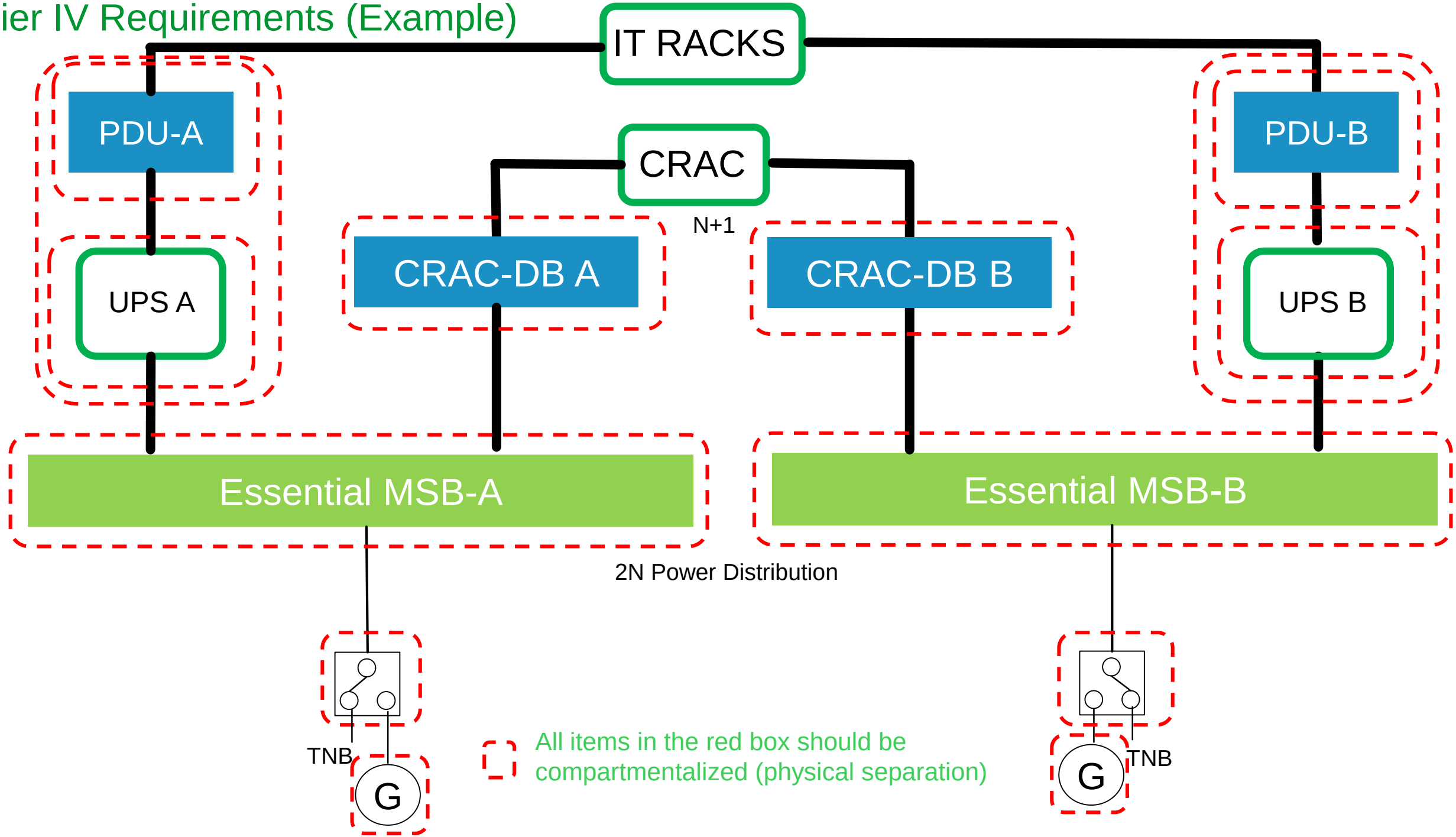

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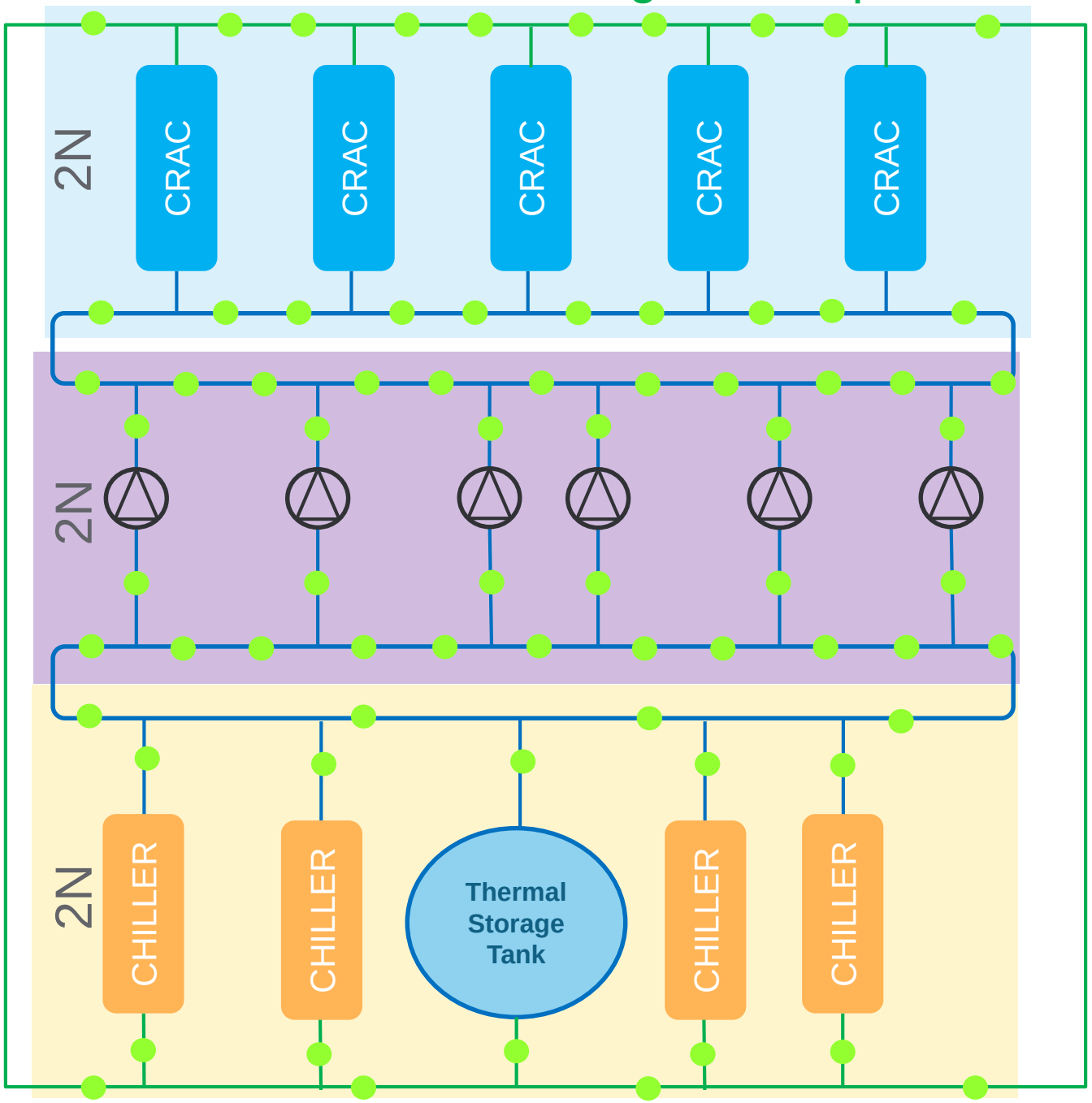

Legend

- Chilled Water Pumps
- Isolation Valves
- Chilled Water Supply
- Chilled Water Return

Tier IV Design:

> Fault Tolerant

> Continuous Cooling

> Compartmentalization

Proposed Design:

> Each pod CRAC with 2N redundancy or C/over

> Pump designed with 2N redundancy

> Chillers designed with 2N redundancy

> Chilled water pipe follows ring circuit design for dual distribution path

> Valve placement for concurrent maintainability

Misconceptions on Tier Rating

- “My data centre is Tier 2.5 or Tier 2+.”
- “For Tier III, I will need 2 separate incoming from the utility power/TNB.”
- “I will need two separate UPS systems on each distribution path for a Tier III rating.”
- “I will need chilled water cooling system in the design to have a Tier III rating.”
- “I must have a high level of physical security or disaster recovery measures in the data centre to achieve a high tier rating.”

- Uptime Institutes assessment of a sites tier readiness is based on the **weakest point**.
- Tier III does not consider utility power as a power supply. Only GENSETs. However, utility power is considered an economical temporary substitute.
- Tier III can be achieved by having an “Active-Passive” design.
- It is possible to use direct expansion cooling to have a Tier III design. Redundancy of the cooling units must be available to meet concurrent maintainability.
- Uptime Institute does not consider security levels or environmental conditions outside the data centre for Tier ratings. Security levels are dictated by:
  - Industry best practices.
  - Criticality of IT functions.
  - Owner’s security policies.

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