

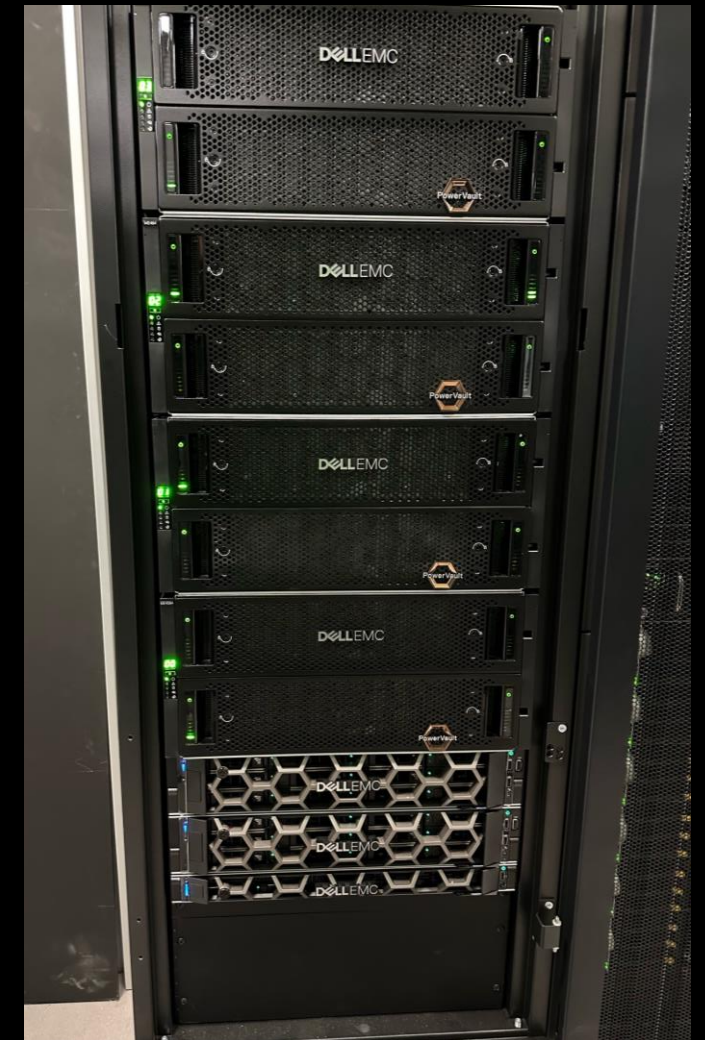
Cluster's Information

Machine Name	Wheeler	HPC Class Cluster	Hopper
Model/Type	Xeon X5550 2.67 GHz	Intel Xeon E5-2670 2.6 GHz	Intel Xeon Gold 6226R 2.9 GHz
Linux Operating System	CentOS 7	Rocky Linux 9	Rocky Linux 8
Interconnect	Mellanox IS5600 ConnectX-2 IB QDR	InfiniBand QDR	InfiniBand HDR
Nodes	304	24	61
Cores/Node	8	16	32
Total Cores	2432	384	2176
RAM/Core	6GB	4 GB	variable
Local disk/node	Diskless	1 TB	Diskless/448 GB(Temp)
Local Scratch Space (TB)	40	6.3	1.2Pb



Storage Information

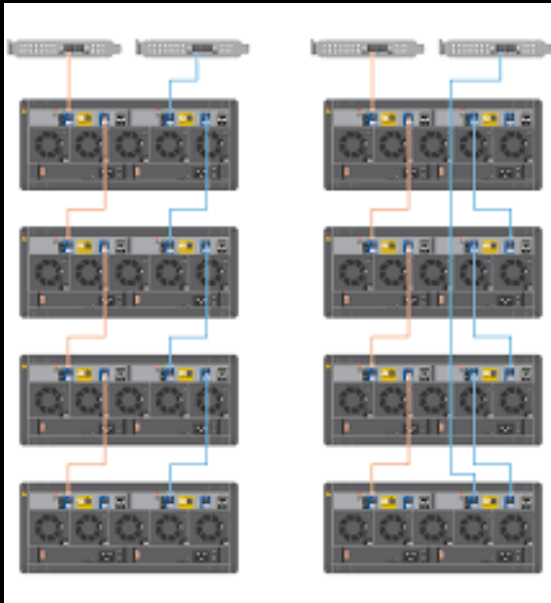
NetApp (Home and Project Dirs)	
Raw Capacity:	2Pb
Connectivity	10Gb Network Ethernet
CARC System Wide Scratch	
Raw Capacity:	1.7Pb (Hopper)
Connectivity	Infiniband 200/100Gb
Local Scratch	
Raw Capacity:	75Tb (Xena, Wheeler)
Connectivity	Infiniband 56Gb/40Gb



CARC Wide Storage - BeeGFS
Parallel File System



● Dell ME484 Storage Shelf



● UPS: Power Consumption

Liebert	Mitsubishi
Rated: 130Kw	Rated:150Kw
Capacity:100Kw	Capacity:120Kw
Total Usable Power:	220Kw (150Kw Currently in used)

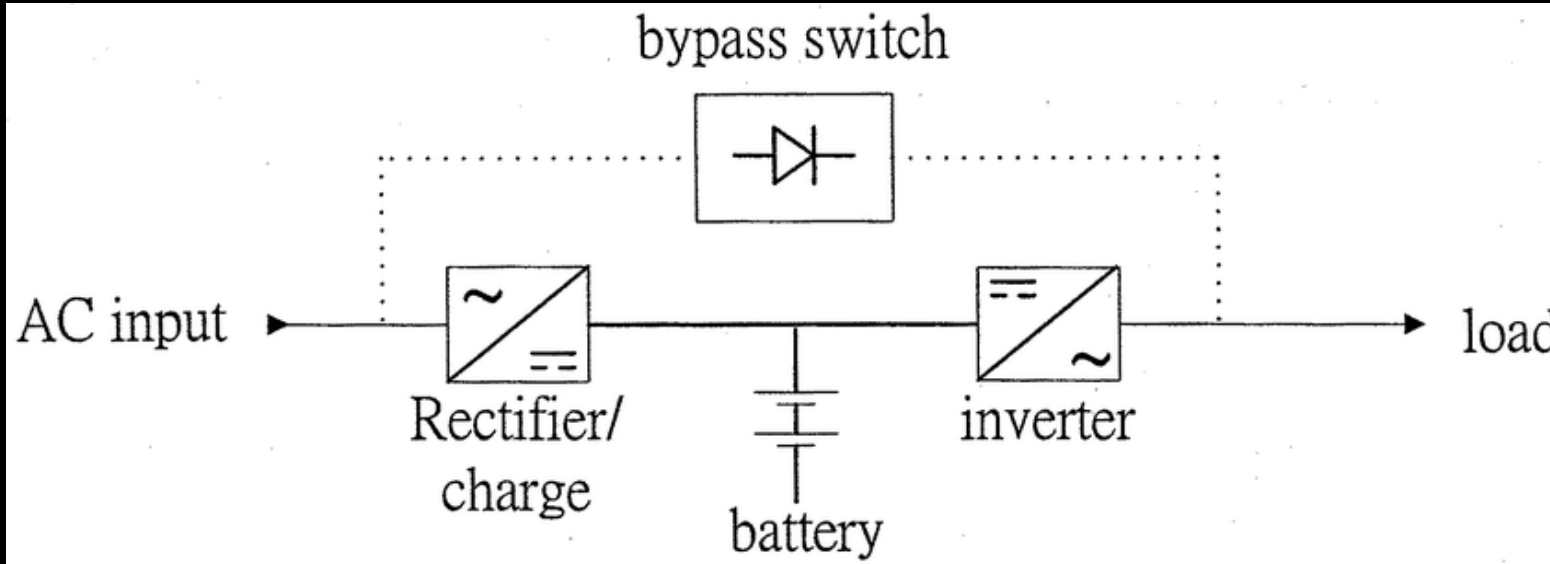
- Examples of power consumption per cluster

Hopper	
54Kw Total	18 Kw per rack (3x)

Wheeler	
80Kw Total	10 Kw per rack (8x)



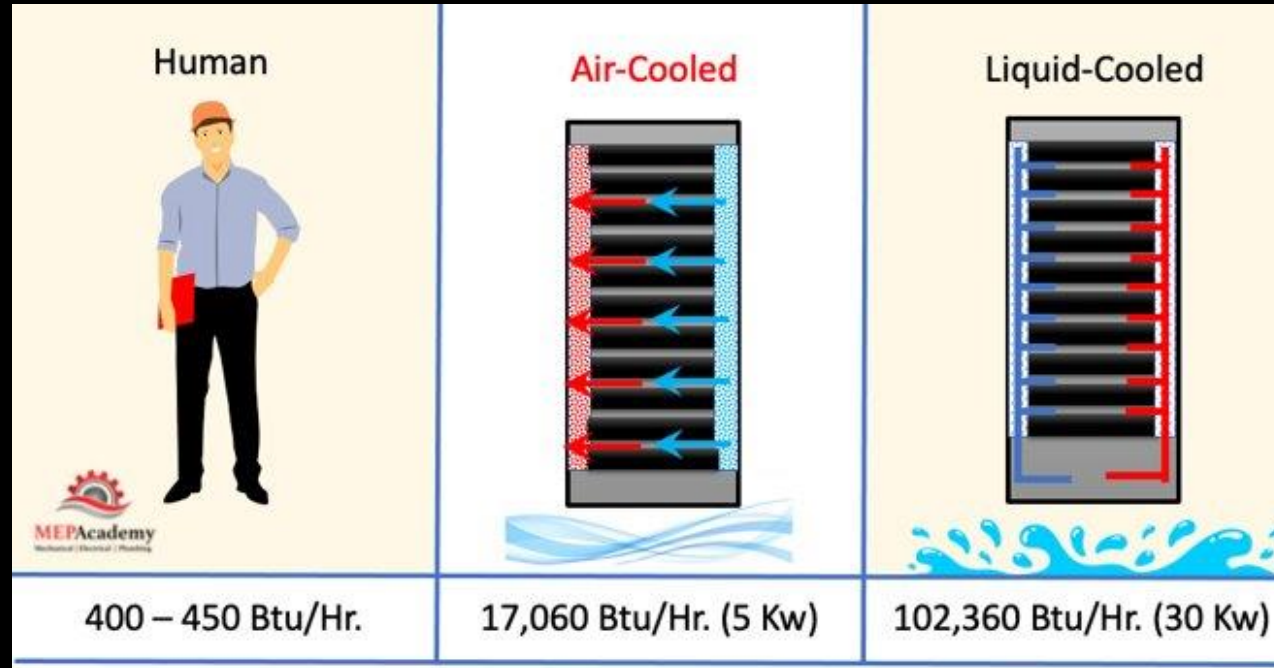
- How an Uninterrupted Power Supply or UPS works?



- **AC Input:** Utility Power (PNM)
- **Rectifier/Charge:** Device that optimize power (clean power) and downgrade to 12volts
- **Battery:** Source of energy connected in parallel (12 volts x 36 batteries = 432Amp hours)
- **Inverter:** converts power from DC to AC (From 12volts DC to 208volts AC)
- **Load:** Energy use to power computers
- **Bypass Switch:** Insolate electrical power incase malfunction UPS.



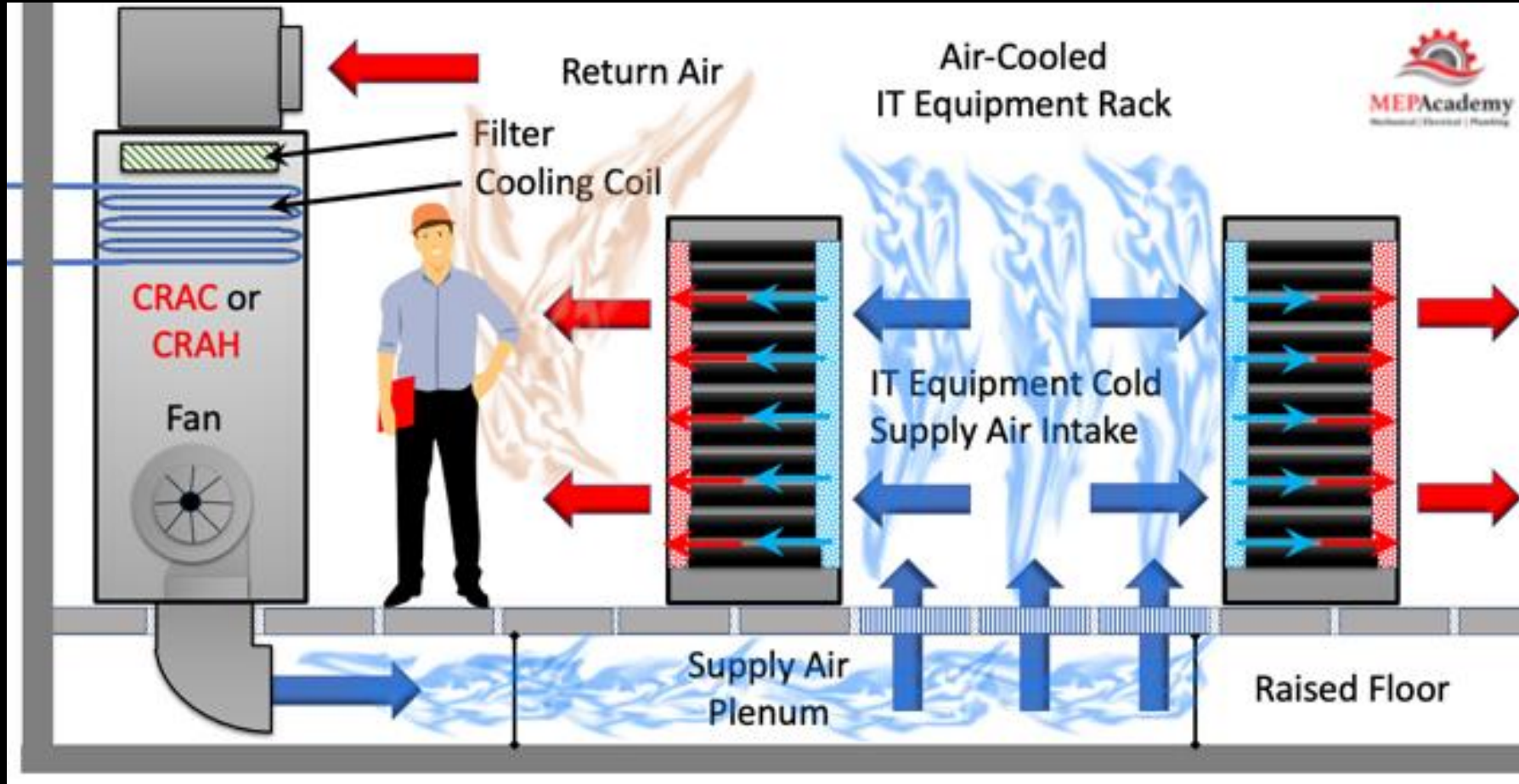
● HVAC System



- The average person sitting gives off 400 to 450 Btu/hour, while one rack of IT Equipment can give off between 17,060 Btu/hour (5 kw) to 102,360 Btu/hour (30 kw). Data centers are energy intensive, and are growing more so.



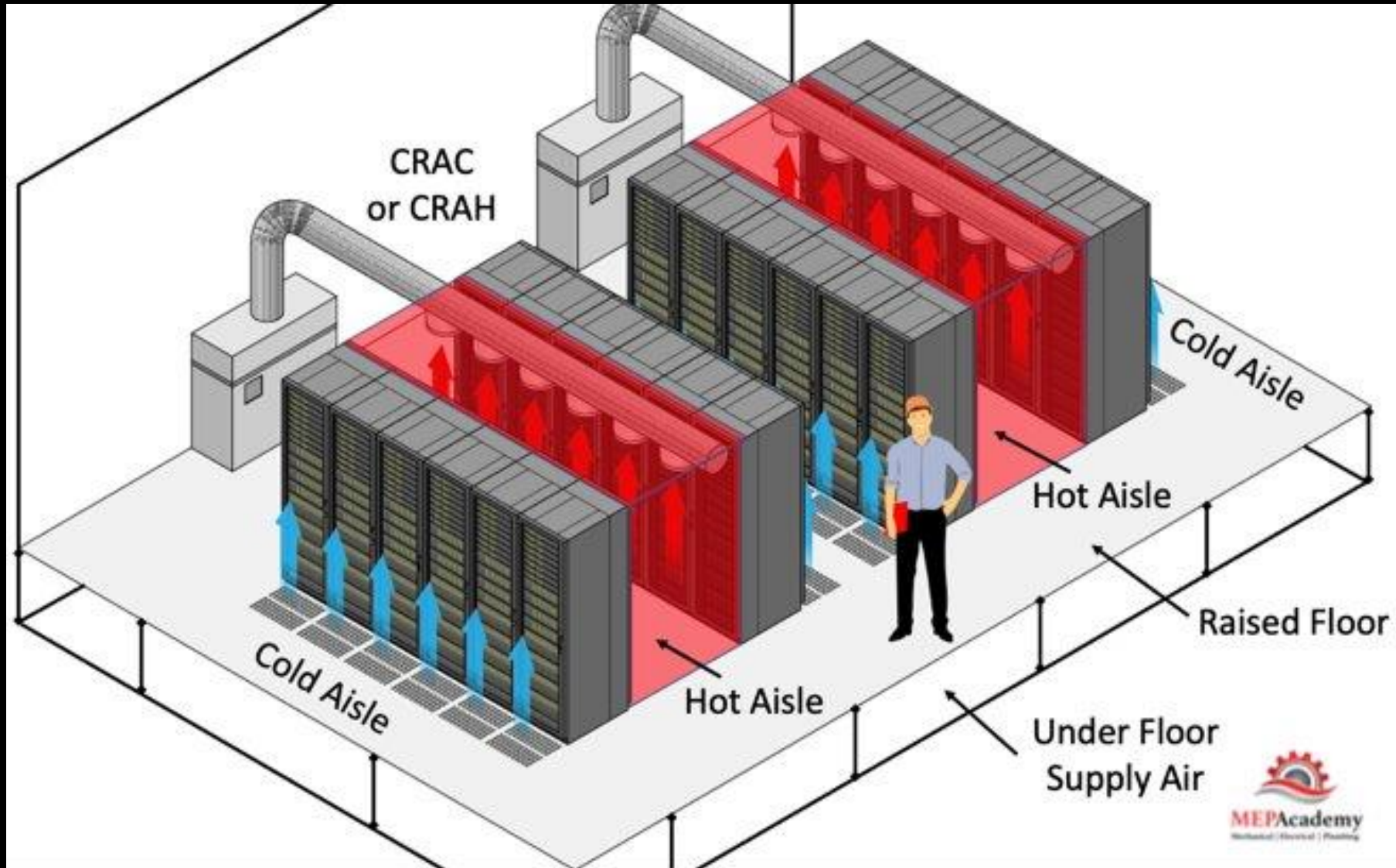
● MMR: Raised Floors – Supply Air



The MMR has 3 CRAC (Computer Room Air Condition) units that support the entire computer room - 1800sq feet , with a total of 90 cubic tons of air.

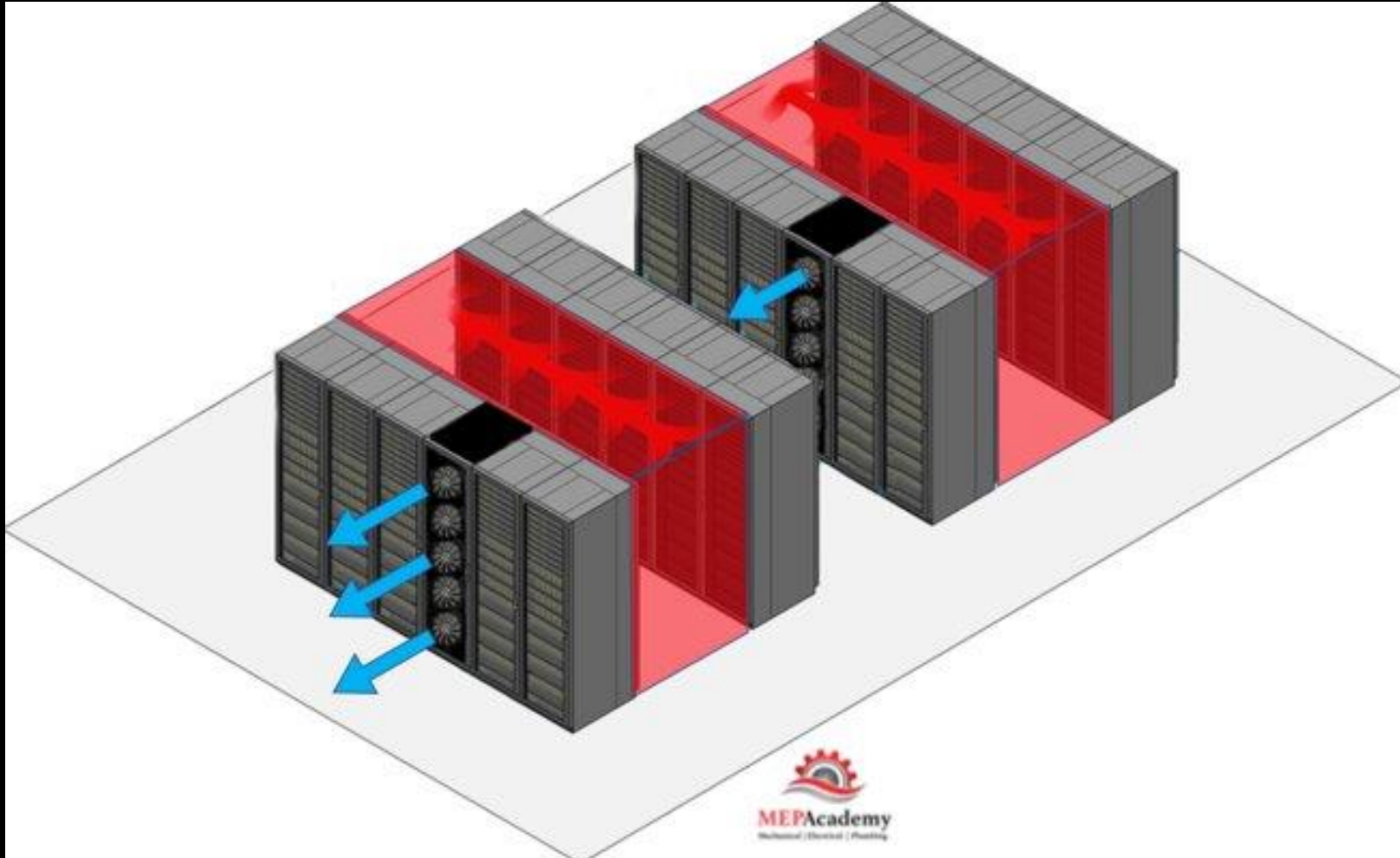


● CARC Main Machine Room: Hot Aisle



In-Row Cooling Units

In-row cooling units sit between the IT equipment racks and take the hot air from the hot aisle, and cool that air before blowing it into the cold aisle where it gets sucked into the IT equipment racks to cool down the equipment.



Liquid Colling System

The heat exchanger in the CDU keeps the two water systems separated so they never mix, allowing the liquid circulating in the racks to be unaffected by the water circulated outdoors. Water from the tower is circulated to the primary side of the heat exchanger in the CDU where it absorbs the heat from the secondary water circulating through the racks.

