Efficient Cooling Technologies for the Critical Environment

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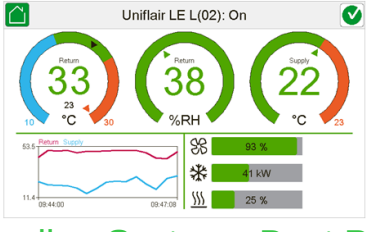
Efficient Cooling Technologies for the Critical Environment

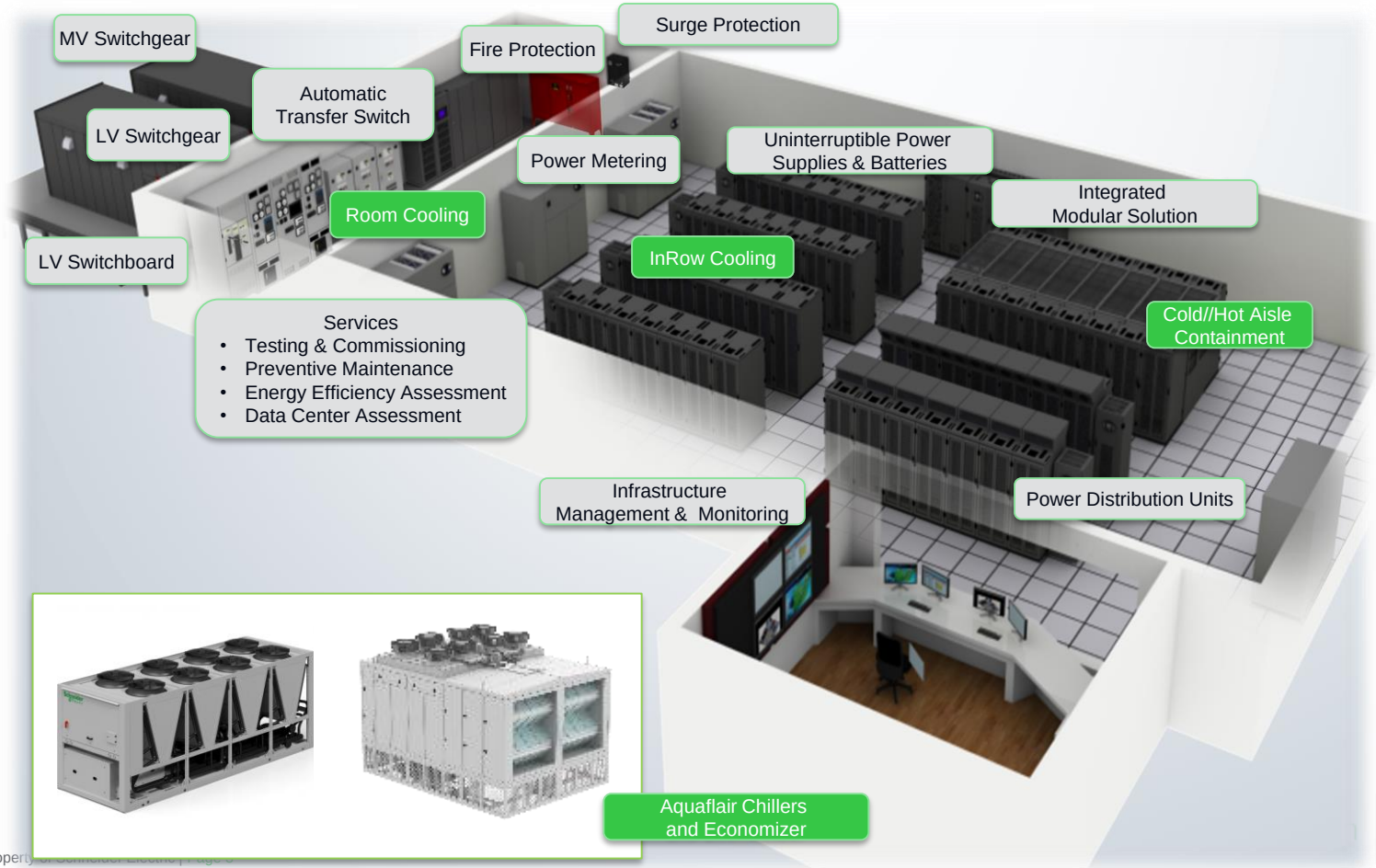
1 Cooling Systems Technology

2 Efficient Cooling Systems



3 Cooling Systems Best Practice

Cooling Systems Technology



Schneider Electric Complete Cooling Solutions (One Stop)

Room

- Amico
- Leonardo
- Leonardo Max
- Wall-mounted
- Monoblock
- Unisplit
- InRoom SC
- Room Air Distribution



Row

- Inrow SC model
- InRow Direct Expansion
- InRow Chilled Water
- Thermal Containment




Rack

- Rack Air Distribution
- InRack direct expansion
- Read Door Heat Exchanger




Building

- Access Flooring
- Technical Chillers
- Free Cooling Chillers and Economizers
- Ecoflair®
- Heat Rejections



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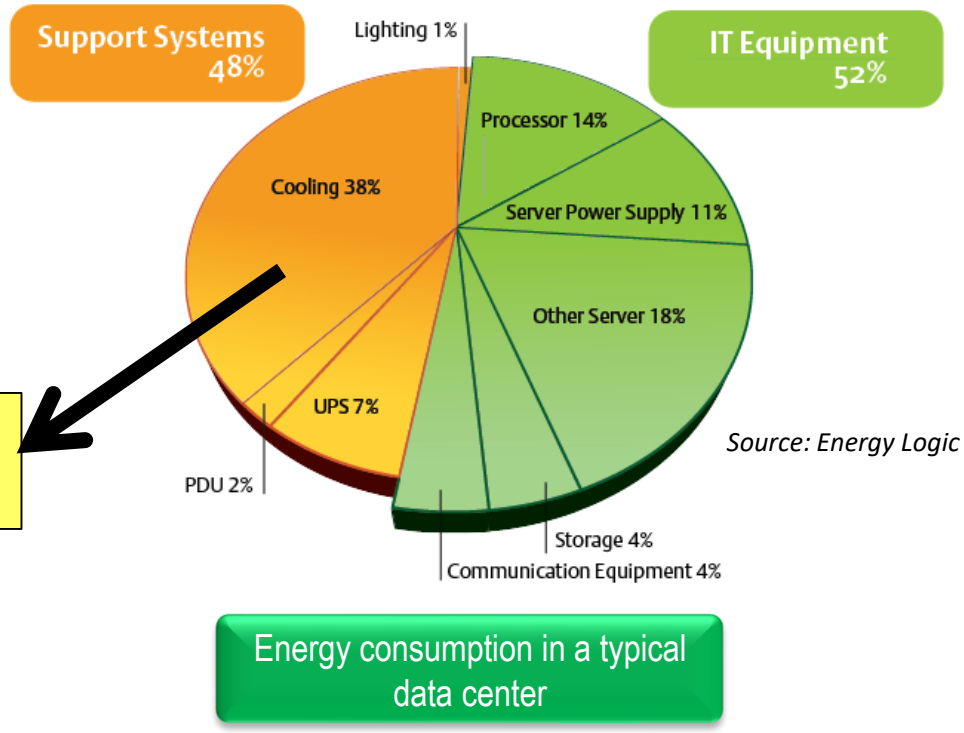
Energy Efficiency, Lower Operating Costs

- Technologies and approaches to reduce operational expenditures (OPEX).
- Focus on operational efficiency of data center environment.
- Simple assessments help identify energy consumption.

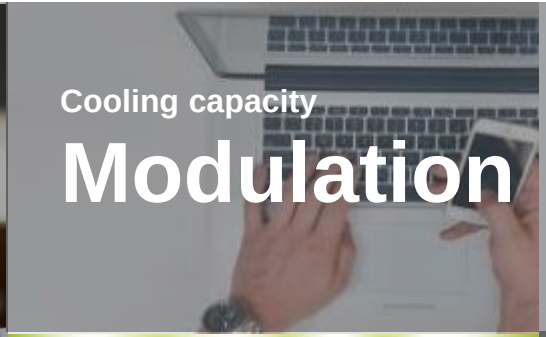


Further Energy Reducing from Cooling System

Source: Energy Logic

Data Center Trends

Capital Expenses
Focus/ Optimization



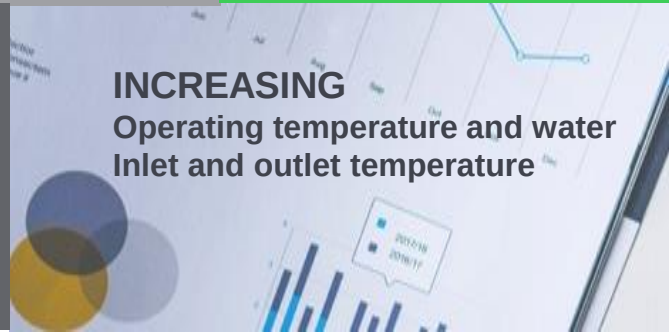
Cooling capacity
Modulation

TIER III&IV
Reliability

Scalable
and modular approach

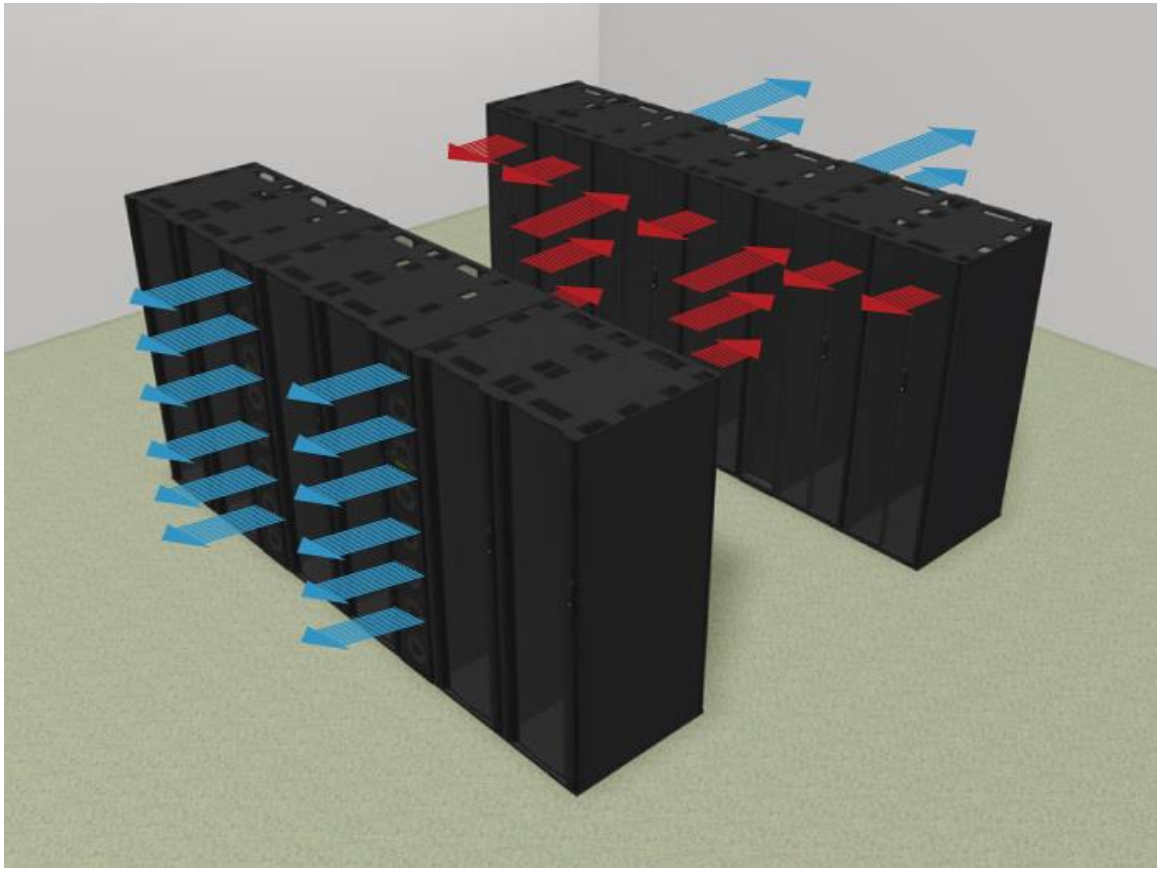
POWER CONSUMPTION REDUCTION
and increasing cooling capacity

Free Cooling
Solutions

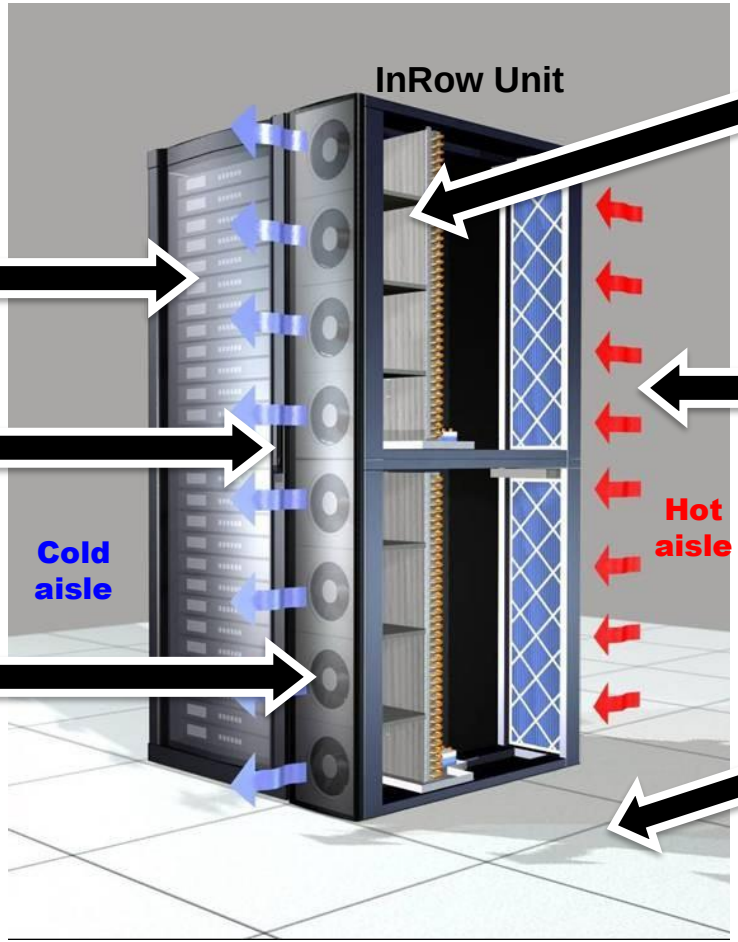


INCREASING
Operating temperature and water
Inlet and outlet temperature

InRow Cooling Architecture



How InRow Cooling Works?



IT equipment intakes cold air and discharge hot air

Cold air is supplied to the cold aisle

Modular type DC fan with variable speed

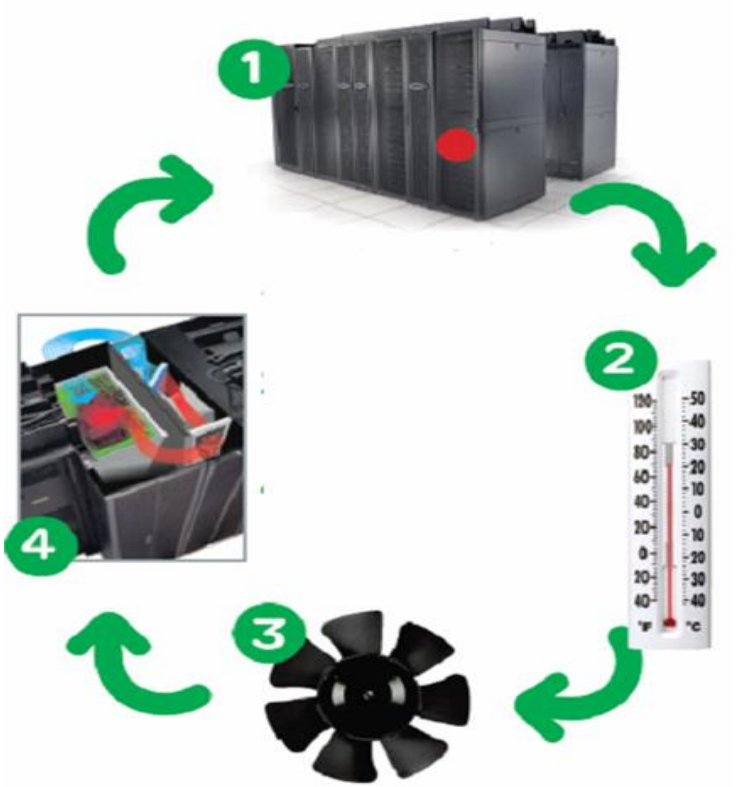
Heat captured and rejected to chilled water or refrigerant liquid

Hot-aisle air enters from rear, preventing mixing

Sitting on hard floor or raised floor

Intelligent Control = Predictable Cooling

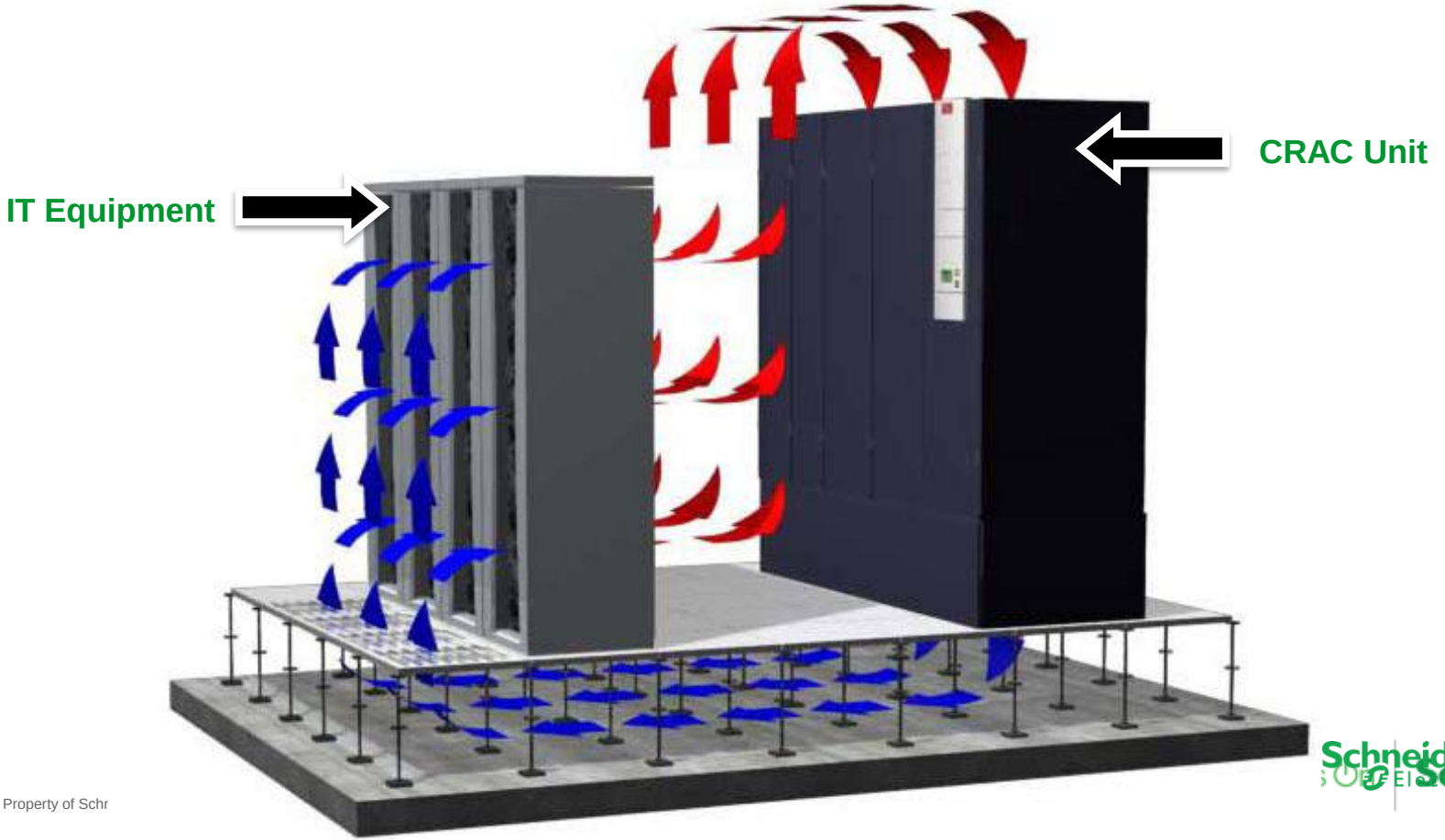
Active Response Controls increase availability by actively responding to thermal changes



1. IT equipment intake cool air and generate hot air
2. InRow temperature probes sense changes and send signal to controller
3. Controller adjusts cooling capacity to balance with the heat load
4. Active Response Controls ensures IT equipment is kept at the proper temperature

Raised Floor Architecture for Air Distribution

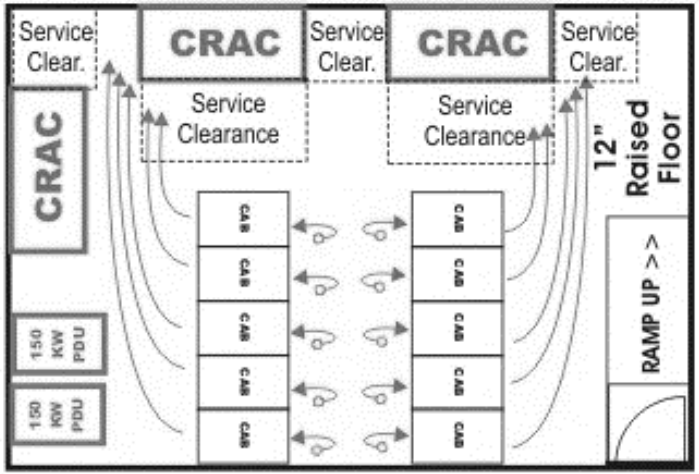
Raised Floor Architecture for Air Distribution



CRAC vs InRow

Traditional Cooling Technology

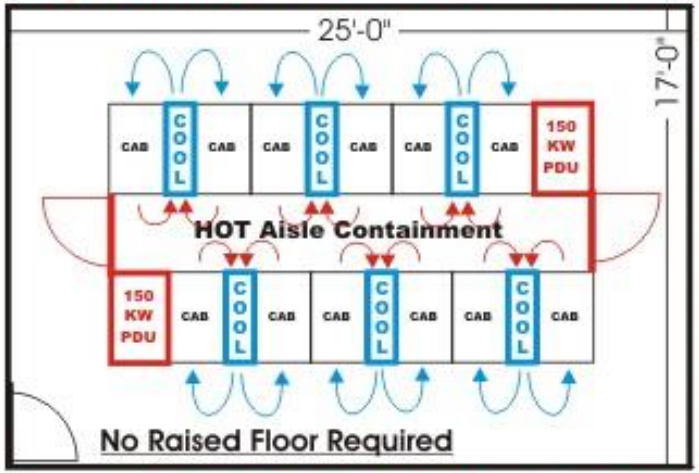
Cool Air From Perforated Floor Tiles



Power=150KW 100% Redundant (2N)
Cooling=80KW (N+1) 3 x 40KW
Payload Space=10 Cabinets=420U
Power per Cab=15.0KW
Cooling per Cabinet Limited to 5KW*
Floorspace=17' x 25"=425 Sq. Ft.

IN-ROW Cooling Technology

High Density Hot-Aisle Containment



Power=150KW 100% Redundant (2N)
Cooling=150KW (N+1) 6 x 30KW
Payload Space=12 Cabinets=504U
Power & Cooling per Cab=12.5KW
Floorspace=17' x 25"=425 Sq. Ft.
No Raised Floor Required

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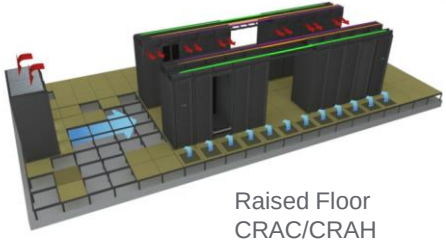
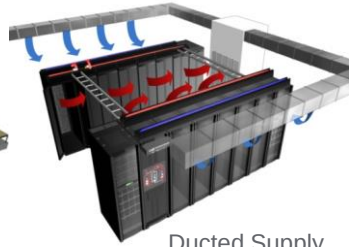
Room Cooling Architecture

Flexible and efficient cooling of network/server/telecom rooms and data centers

- Flexibility
  - Room level control and air distribution
    - Humidity Control
    - Lighting/People
  - Racked and Non-racked IT loads
  - Raised floor and Ducted

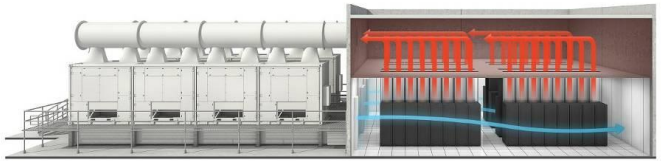


Raised Floor
CRAC/CRAH



Ducted Supply
CRAC/CRAH

- Efficiency
  - EC Fan Technology to reduce fan power
  - Large Coil area to maximize capacity and Economizer Hours
  - Air Economizer to minimize mechanical cooling



Ducted Return
Air Economizer

Efficient Cooling Systems

2011 ASHRAE Thermal Guidelines

Classes (a)	Equipment Environmental Specifications							
	Product Operations (b)(c)					Product Power Off (c) (d)		
	Dry-Bulb Temperature (˚C) (e) (g)	Humidity Range, non-Condensing (h) (i)	Maximum Dew Point (˚C)	Maximum Elevation (m)	Maximum Rate of Change(˚C/hr) (f)	Dry-Bulb Temperature (˚C)	Relative Humidity (%)	Maximum Dew Point (˚C)
Recommended (Applies to all A classes; individual data centers can choose to expand this range based upon the analysis described in this document)								
A1 to A4	18 to 27	5.5ºC DP to 60% RH and 15ºC DP						
Allowable								
A1	15 to 32	20% to 80% RH	17	3050	5/20	5 to 45	8 to 80	27
A2	10 to 35	20% to 80% RH	21	3050	5/20	5 to 45	8 to 80	27
A3	5 to 40	-12˚C DP & 8% RH to 85% RH	24	3050	5/20	5 to 45	8 to 85	27
A4	5 to 45	-12˚C DP & 8% RH to 90% RH	24	3050	5/20	5 to 45	8 to 90	27
B	5 to 35	8% RH to 80% RH	28	3050	NA	5 to 45	8 to 80	29
C	5 to 40	8% RH to 80% RH	28	3050	NA	5 to 45	8 to 80	29

Recommended Inlet Air Temperature Entering Datacom Equipment is 18 to 27°C

From ASHRAE White Paper

Radical EC Fan

Efficient

Main benefits

Latest Generation of Radical Brushless Electronically Commutated fans give great benefits in terms of:

- Very high reliability (brushless)
- High performance with low noise, thanks to a particular shape of this last generation impeller
- New Impeller design improve the aeraulic of the fan maximizing the efficiency and reducing power consumption
- Continuous fan speed regulation provided by the BMS
- Service oriented designed to provide easier serviceability with a quick-removability kit

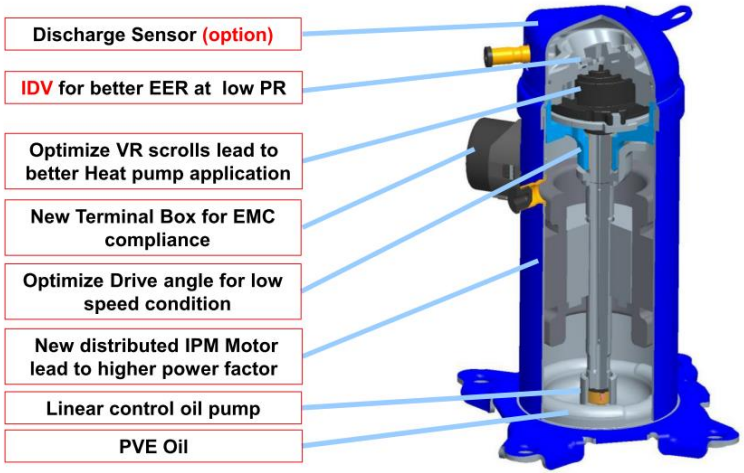
Latest Generation Brushless Compressors

Main benefits of Brushless Compressors

Efficient

Latest Generation of Brushless compressors have great benefits in terms of:

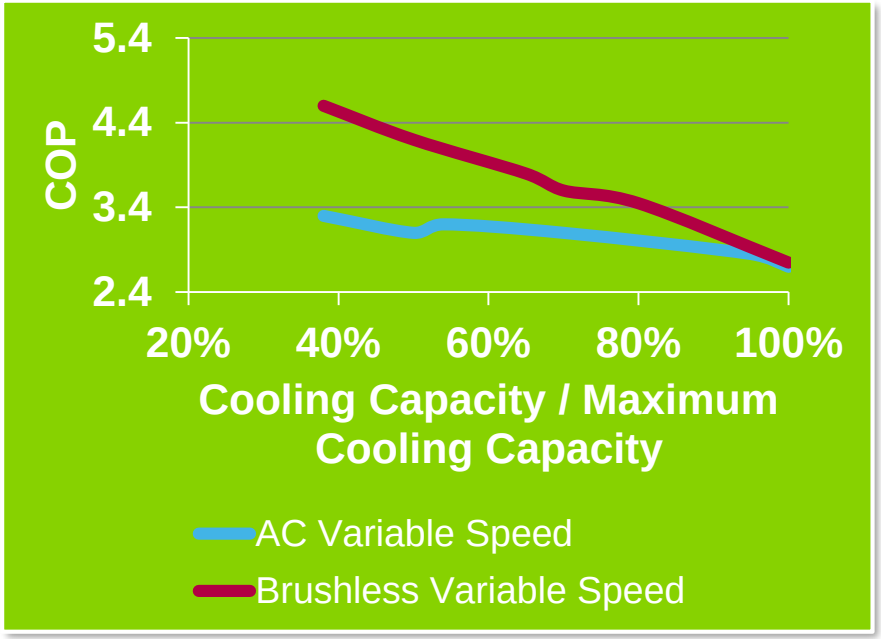
- Very high reliability
- High performance with high efficiency at partial load
- New IDV valve to improve efficiency at partial load
- Enhanced Envelope suitable for high temperature application on 1922 and 2022 models
- Enhanced Envelope suitable for high temperature application on all other models on fix speed section

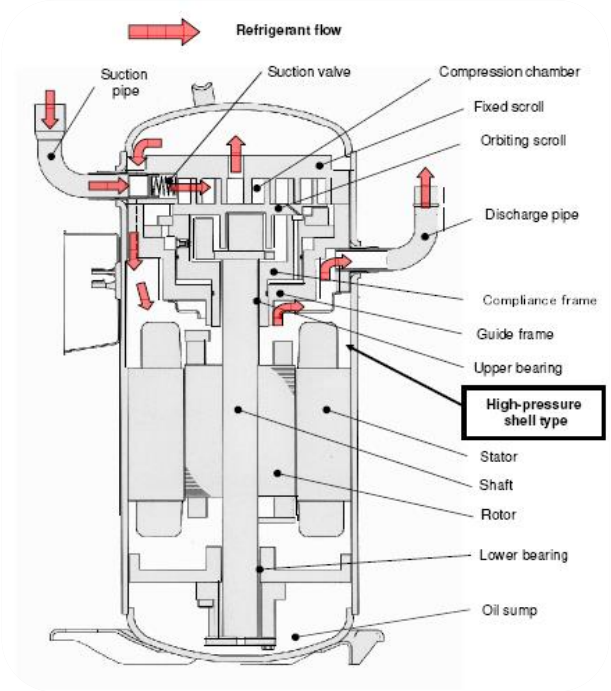


Brushless Motor Compressors Benefit

Efficient

Increased energy efficiency at partial loads thanks to Brushless compressors.

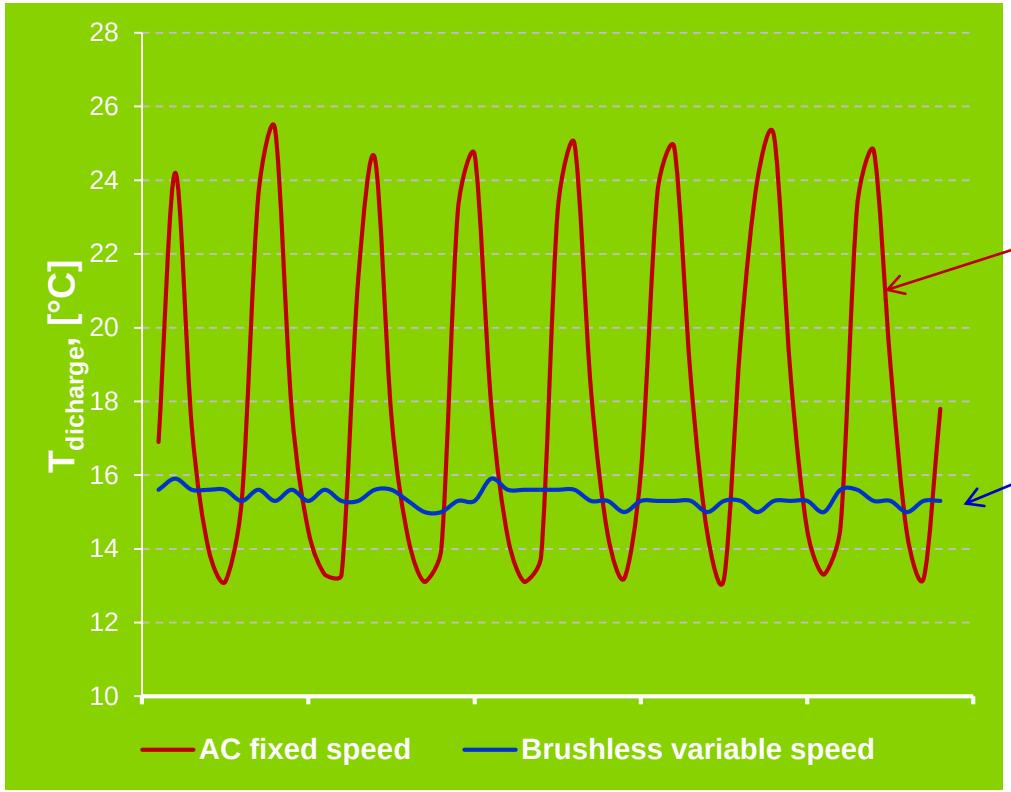




Discharge Temperature Control

Efficient

High precision in temperature regulation



$T_{discharge}$ = 18,1°C ± 6,1°C

Treturn = 23°C ± 0,5°C

$T_{discharge}$ = 15,4°C ± 0,4°C

Treturn = 23°C ± 0,1°C

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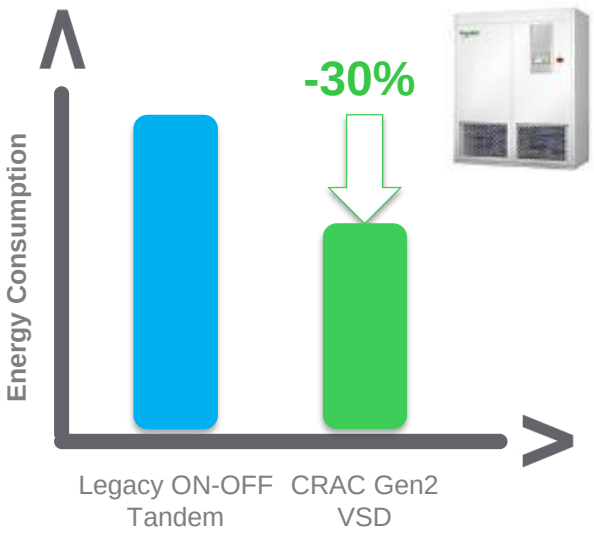
VSD DX Systems – CAPEX & OPEX Reduction

Efficient

Impact on units

- CRAC units with VSD Brushless scroll compressors reduce yearly energy consumption of **30%** compared to ON-OFF Tandem technology.
- The inverter technology on scroll compressor provide benefits also in terms of current absorption, reducing the electrical infrastructure cost.



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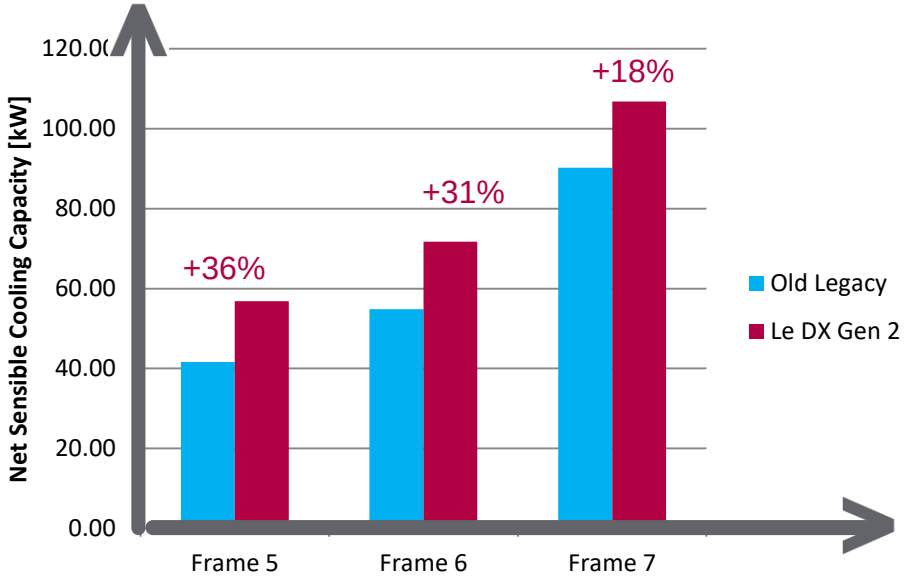
Capacity Maximization (Fan In The Box)

Comparison between new range (LDAV and IDAV) and old range (TDAV)

Efficient

- Cooling capacity maximization: up to **+36%** in the same footprint for fixed speed and VSD.



LE DX Gen 2

Legacy Model

Nom. Cond. 45°C condensation, return air 24°C

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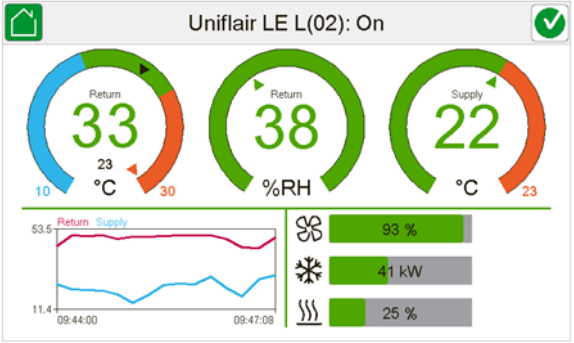
Integrated SE IT-Touch screen

Main fetaures

Flexible

- Integrated **Touchscreen** in the units with main parameters easy visulaization
- Integrated **TCP/IP** and USB card for firmware upgrade
- Integrated **Management** for all the working parameters
- Integrated **Unloading logic on VSD** units to avoid high pressure trips events
- Full management of the Condenser status including single fan status



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Double Power Supply

Single and double power supply

Reliable

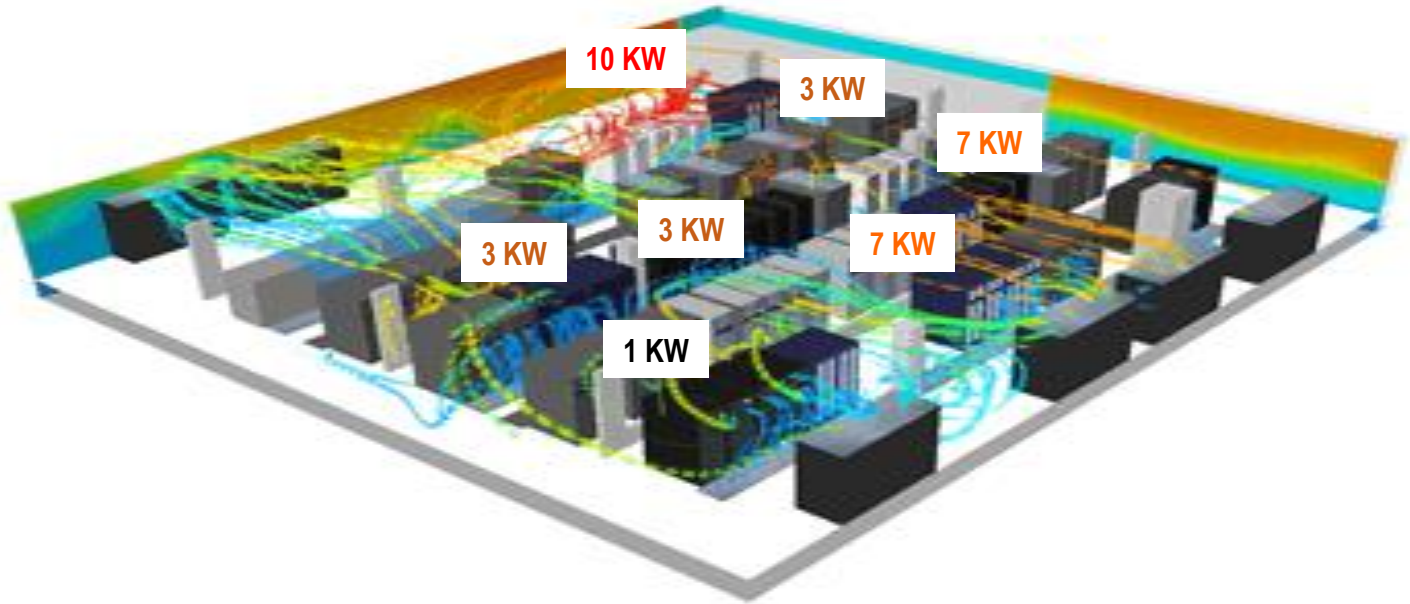
- **Double** power supply with automatic commutation (ATS) for complete redundancy without single point of failure as per TIER recommendations

Cooling Systems Best Practice

Old Method of Cooling for today high density poses problem!

Problems!! -

- Hot air re-circulating back to servers.
- Insufficient air distribution.
- Mixing of hot air with cold causes energy wastage



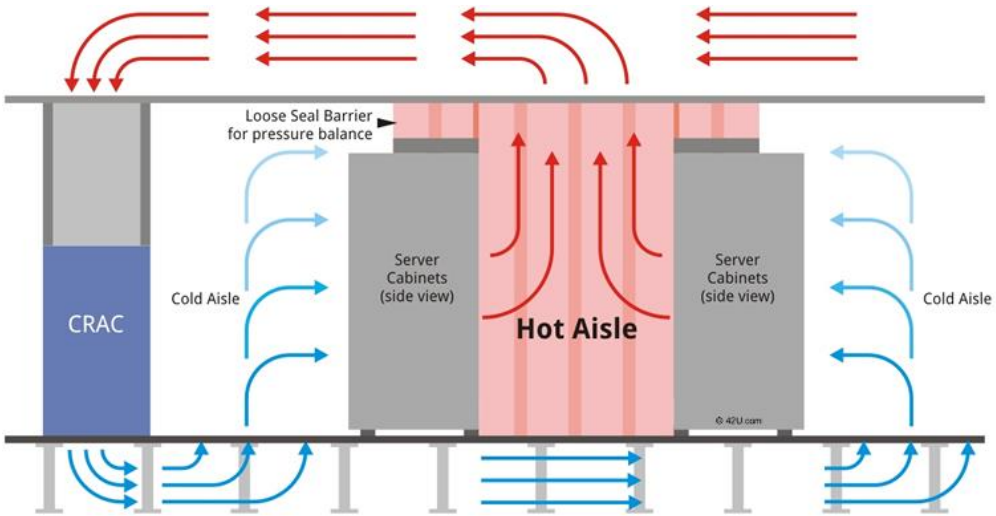
NETSHELTER ECOAISLE THERMAL CONTAINMENT SYSTEMS

EcoAisle

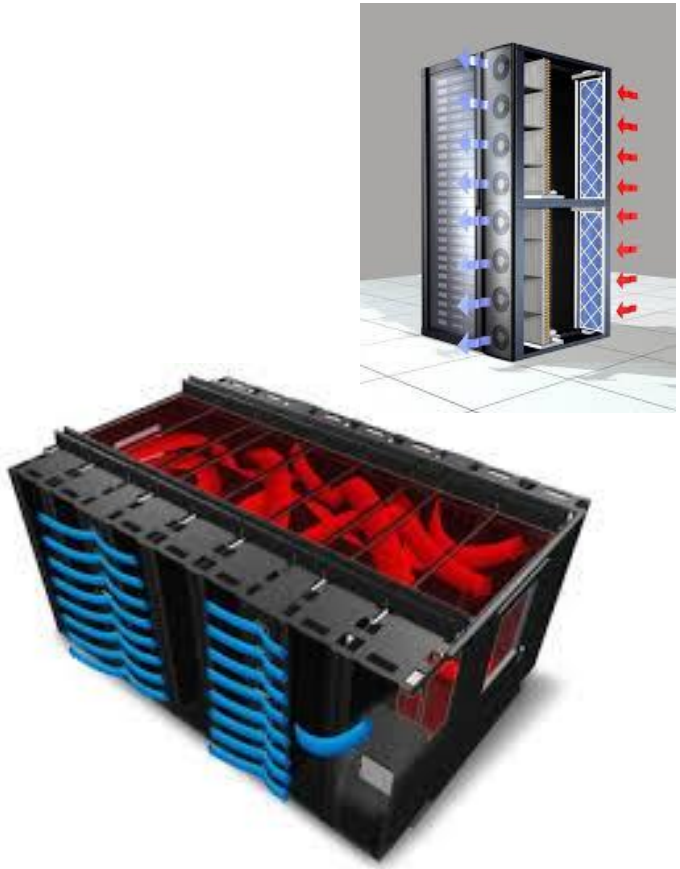
THERMAL CONTAINMENT SYSTEMS

- In today’s data centers, traditional cooling approaches involve complex air distribution systems that tend to be unpredictable and leave many customers guessing where the cold air goes.
- The EcoAisle minimizes the hot and cold air mixing within the IT environment.
- increases efficiency and provides a predictable cooling architecture.

Implementing Thermal Containment Systems in Data Centers



Perimeter Cooling



Row Based Cooling

Pros and cons of the six air containment methods

Containment method		Pros	Cons
Cold air containment	Cold aisle containment system	Easy and cost effective for raised floor applications; cooling capacity can be shared with other racks within two rows; fastest deployment time of all containment types	Lower number of free cooling hours; creates uncomfortable working environment in uncontained areas
	Row-cooled, cold aisle containment system	In-row cooling units increase cooling capacity of existing CACS environment with perimeter cooling units; prepackaged solution can save deployment time	Higher first capital cost; need to move IT racks to insert row-based cooling units within row
Hot air containment	Ducted rack	Easy to deploy for scattered HD racks; Don't require a hot aisle / cold aisle arrangement; can be deployed piece by piece to reduce upfront capital cost; offers higher number of free cooling hours	May cause pressure imbalance inside of drop ceiling or between nearby racks; increased labor time; longer deployment time for each rack
	Ducted, hot aisle containment system	Creates comfortable work environment in uncontained areas; cooling capacity can be shared with other racks within two rows; offers higher number of free cooling hours	High temperature in the hot aisle may create uncomfortable work environment in contained area, longer deployment time for each rack
	Row-cooled, hot aisle containment system	Low-cost option for data centers with existing row-based cooling. Thermally neutral to the existing room-based cooling system; cooling capacity can be shared with other racks within two rows; prepackaged solution can save deployment time	In data centers with existing perimeter cooling units: Higher upfront capital cost; need to move IT racks to insert row-based cooling units within row. High temperature in hot aisle may create uncomfortable work environment in contained area
	Rack air containment system	Almost immune to the constraints of existing facility; easy to plan for any power density; isolated from the existing cooling system; attenuates noise	In data centers with existing perimeter cooling units, has the highest first cost because more cooling units are needed; cooling capacity can't be shared with other racks; containment will add the depth of rack which will consume more floor space

Thank You

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