Dealing with Hotspots in Datacenters Caused by High-Density Computing

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InfraStruXure
POWER RACK COOLING
Open, adaptable and integrated architecture for on-demand network-critical physical infrastructure

BLADE READY

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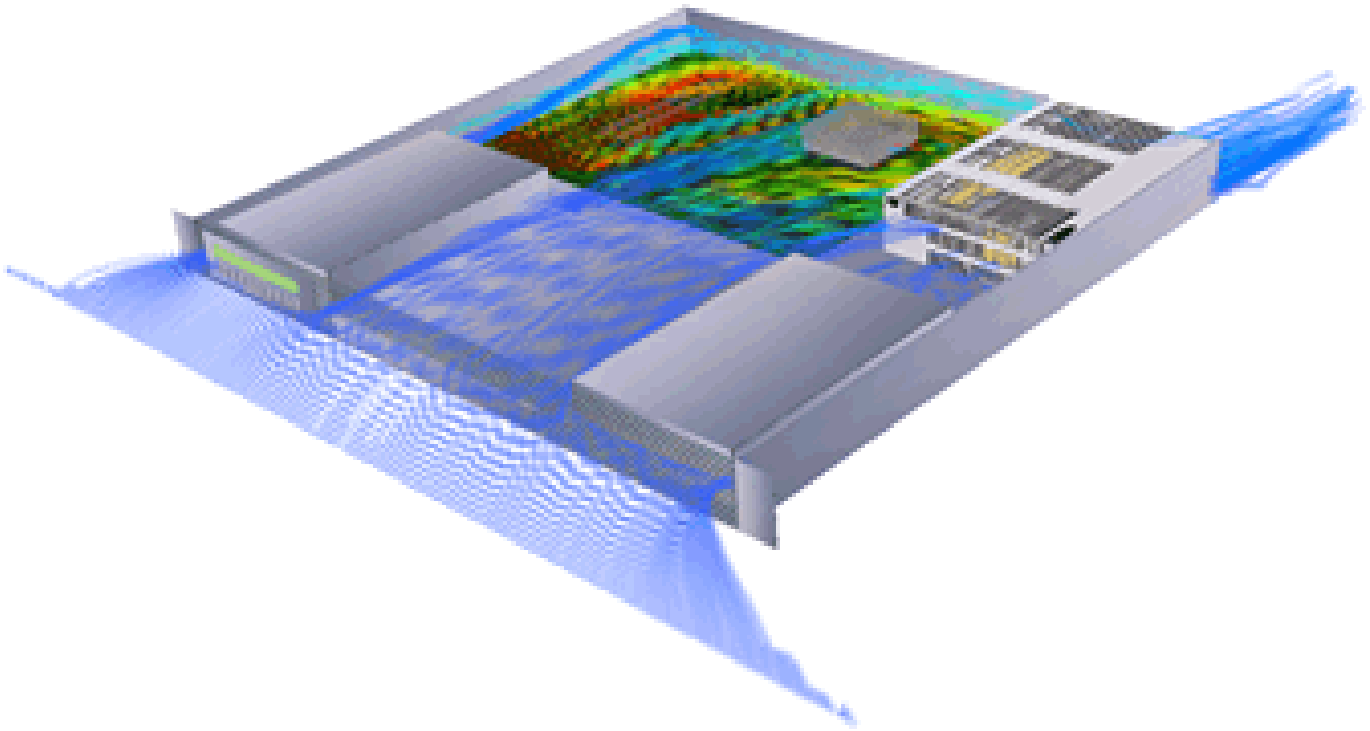
Thermal Management

- **The increase in power densities in modern electronics is having a direct impact on the environment housing them**
- **Thermal management of equipment housed in an enclosure is fast becoming the most serious risk to availability in today's Mission Critical Facilities (MCF)**
- **Cooling high power density equipment demands a far more accurate method of controlling air movement in an MCF**

Cooling the server



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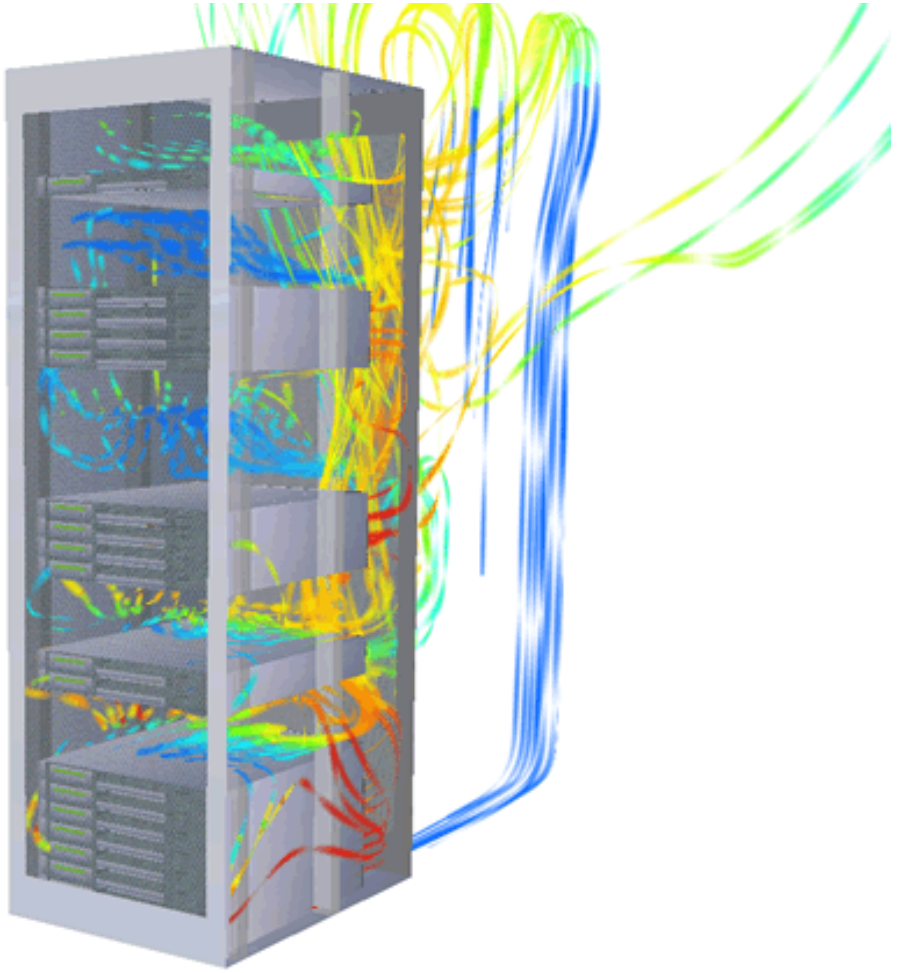
Cooling the cabinet



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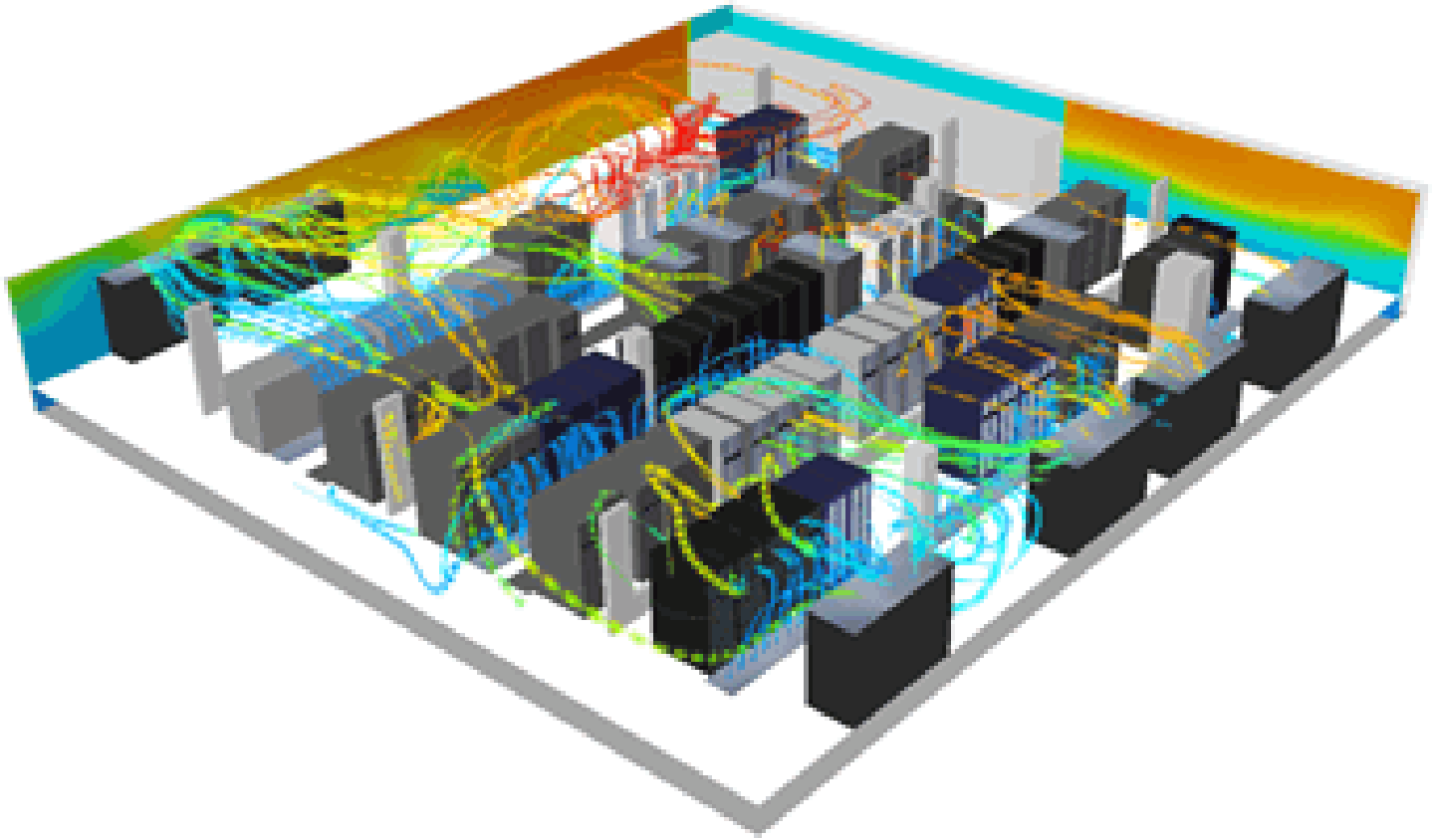
Cooling the data center



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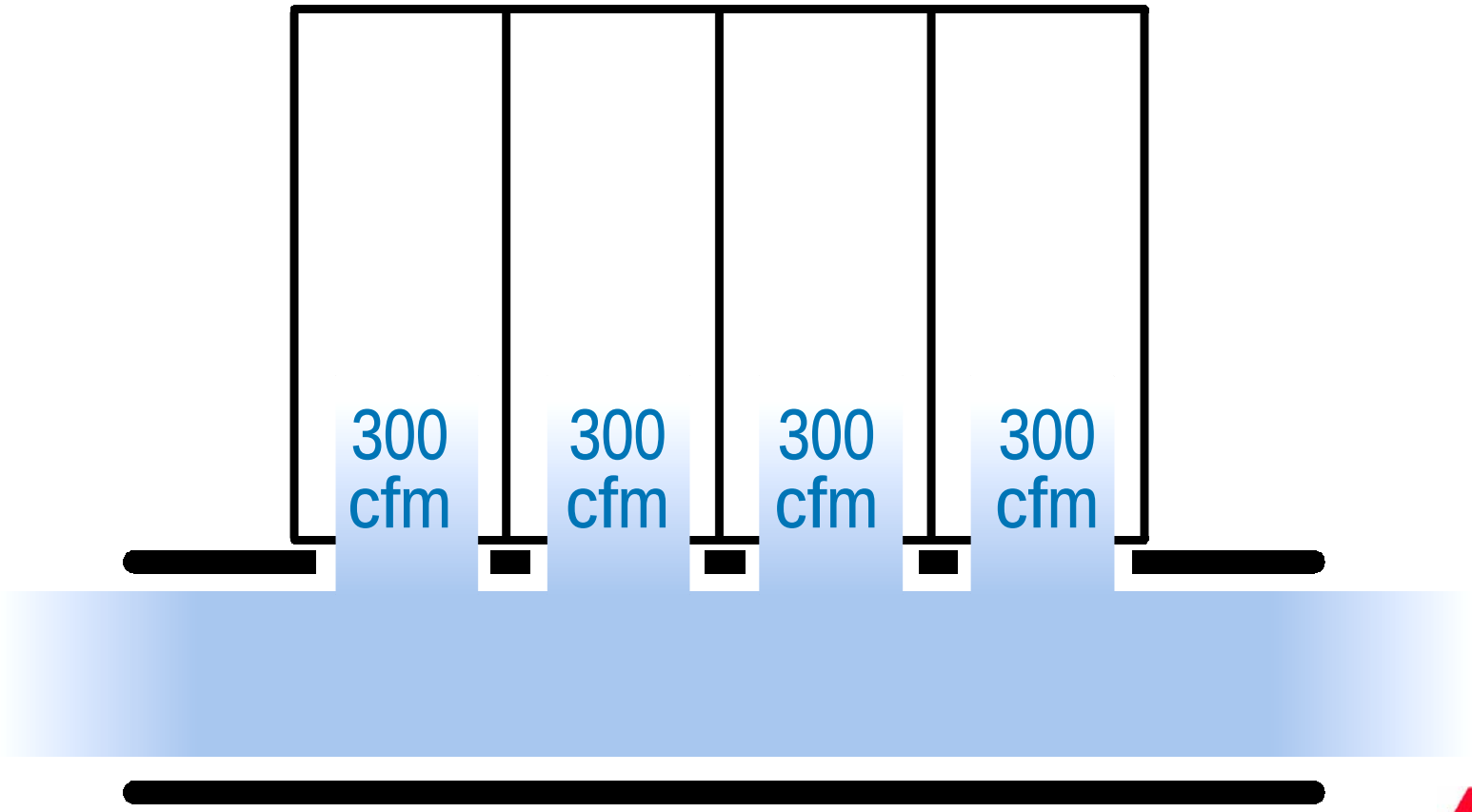
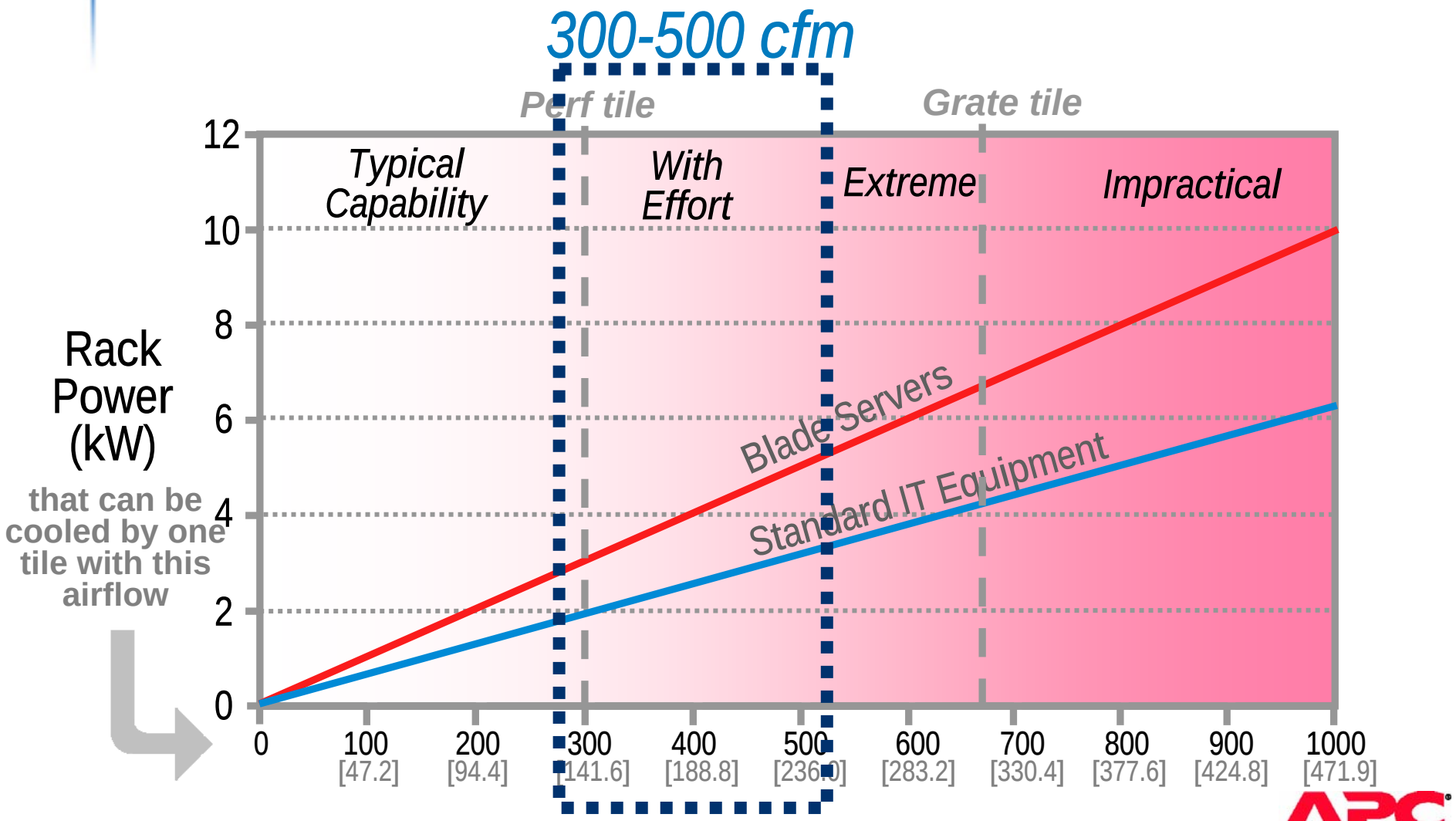
Typical Raised-Floor Airflow

One 300 cfm(141.6 lps) vented tile per rack



Floor Tile Cooling Ability



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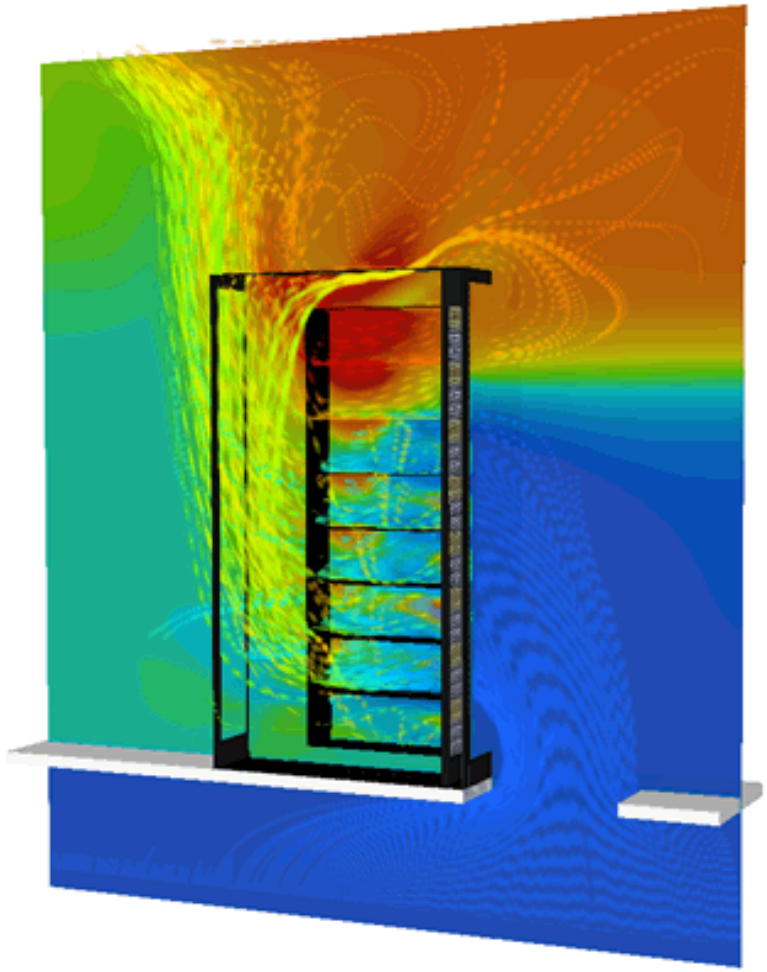
Rack Cooling using Sub-Floor Airflow



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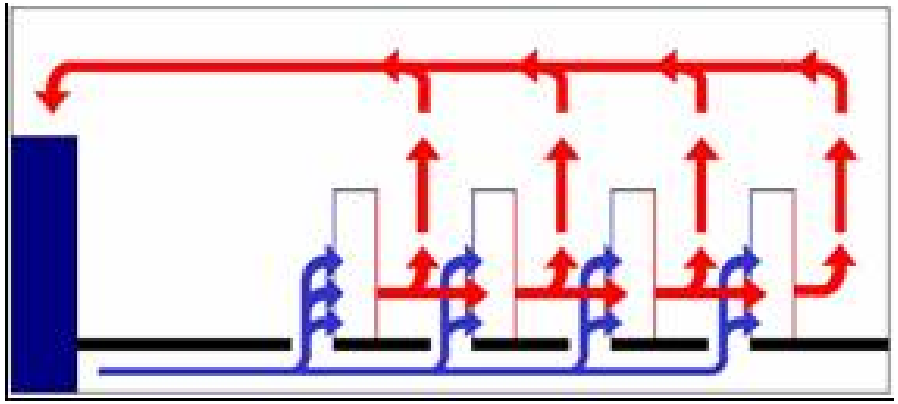
Implement Hot Aisle / Cold Aisle

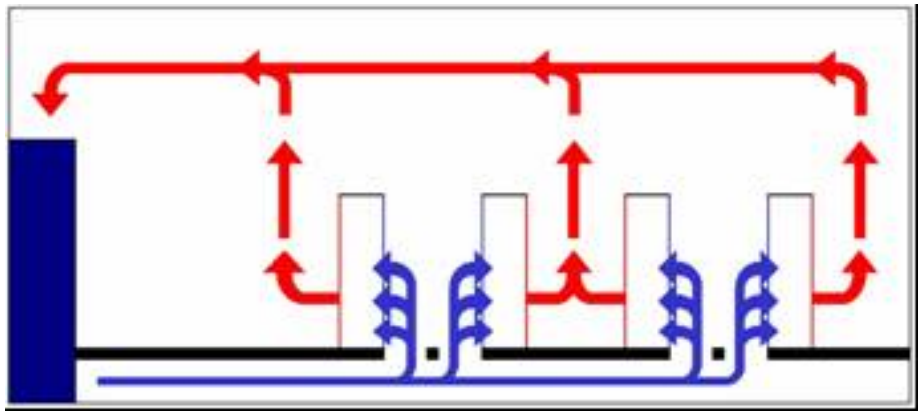
Racks face same direction

- Most rack-mounted servers draw air in the front and exhaust at the rear
- Exhaust air mixes with cold air with no aisle separation

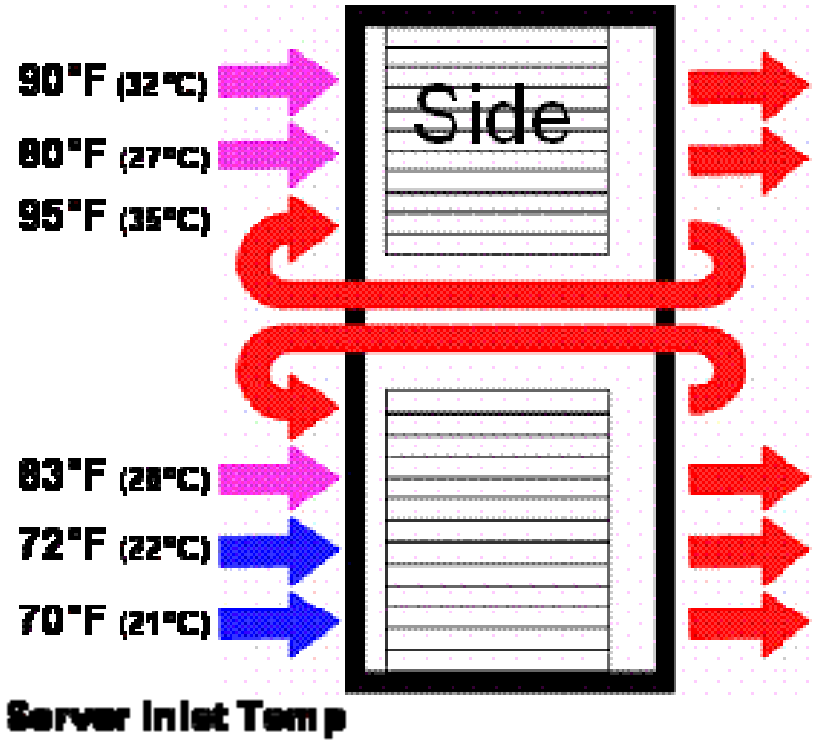


Racks facing each other

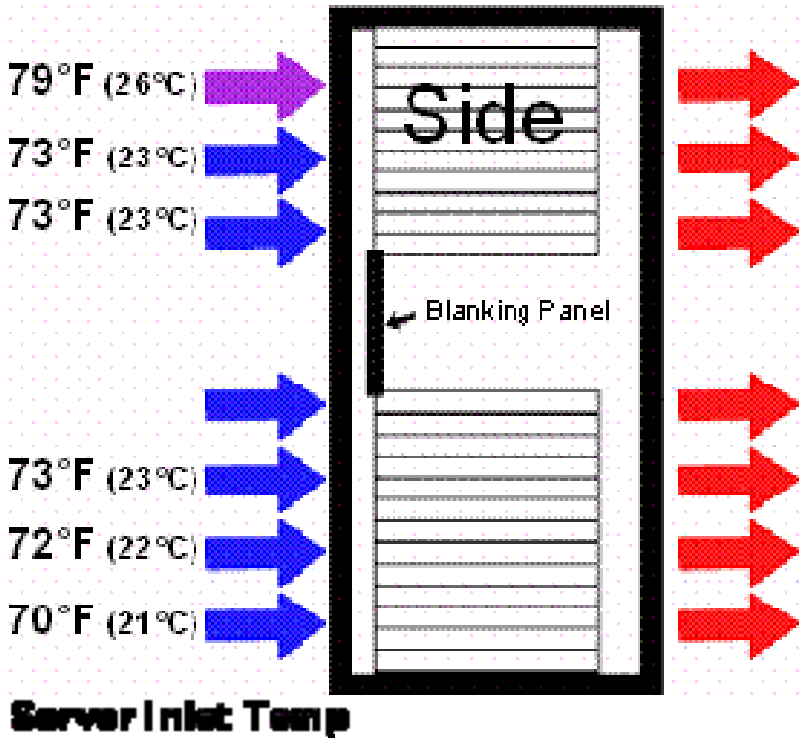
- Reduced temperature in cold aisle
- Reduced air mixing
- Higher return air temperatures to CRAC



Effect of Adding Blanking Panels



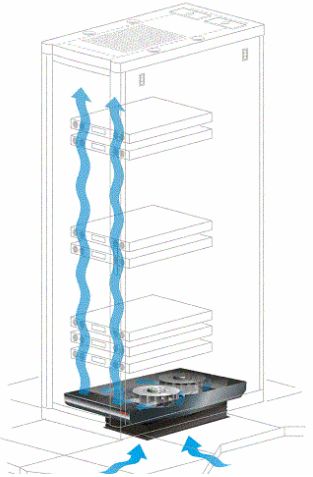
Without Blanking Panels



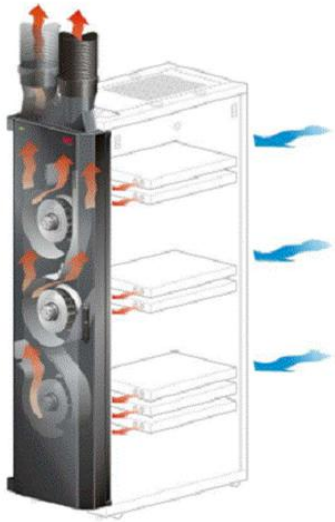
With Blanking Panels

Install Airflow Assisting Devices

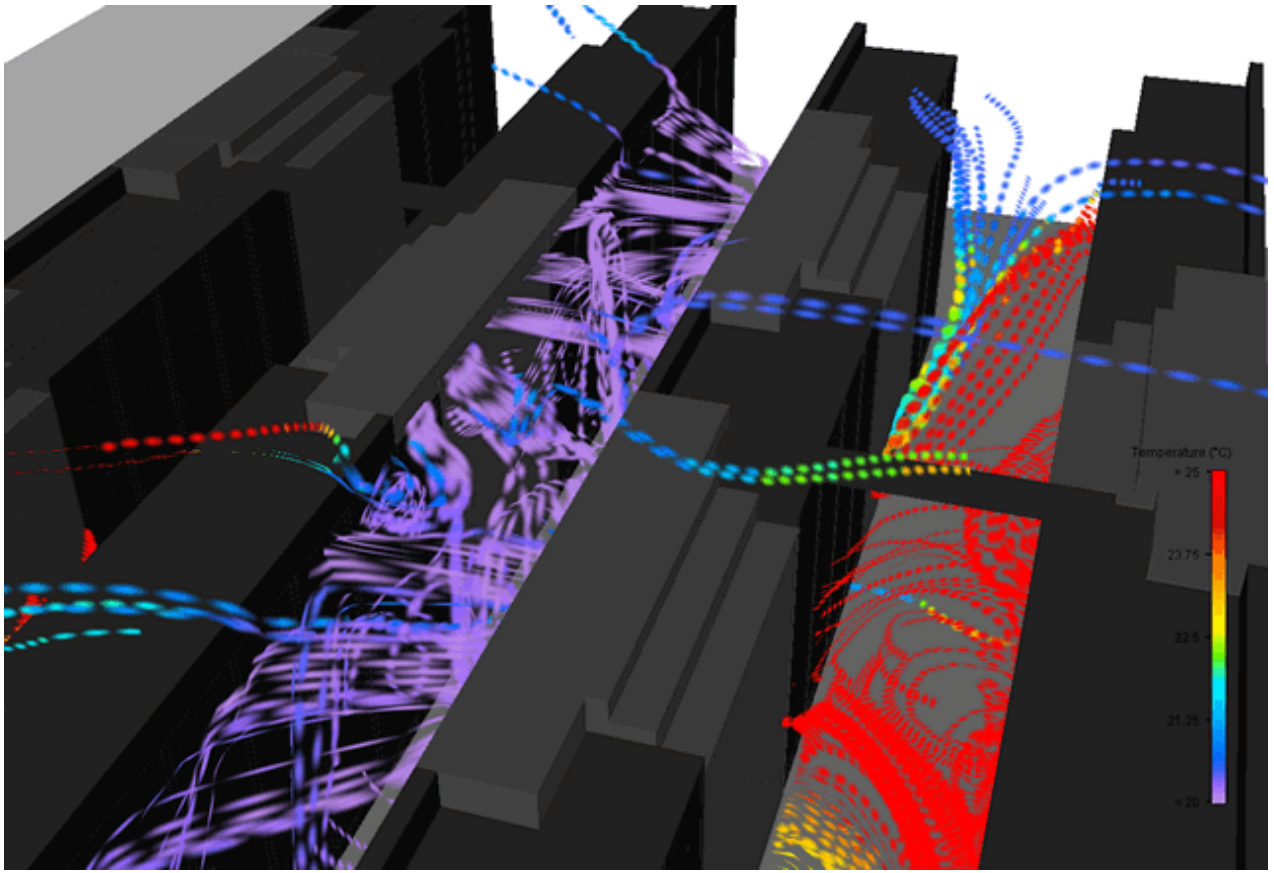
- **Fan-tray devices, such as APC's Air Distribution Unit, draw air from sub-floor plenum to create cold air curtain between front door and server inlets.**
- **Rack densities increase to 3 kW**



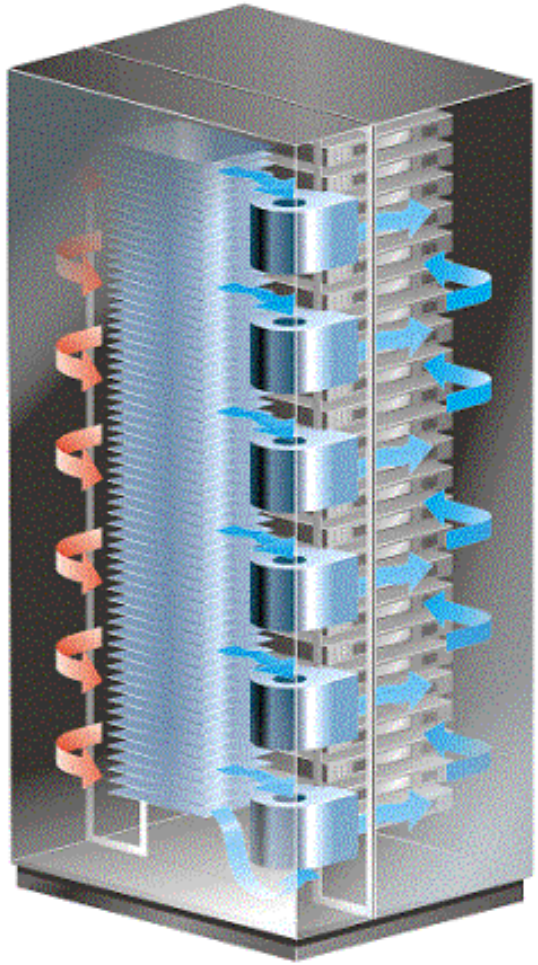
- **For higher densities replace rear door of rack with APC's Air Removal Unit to draw air in horizontal plane from cold aisle into server inlets**
- **Rack densities increased to 7kW**



In-Row Cooling



High Density Cooling Enclosure



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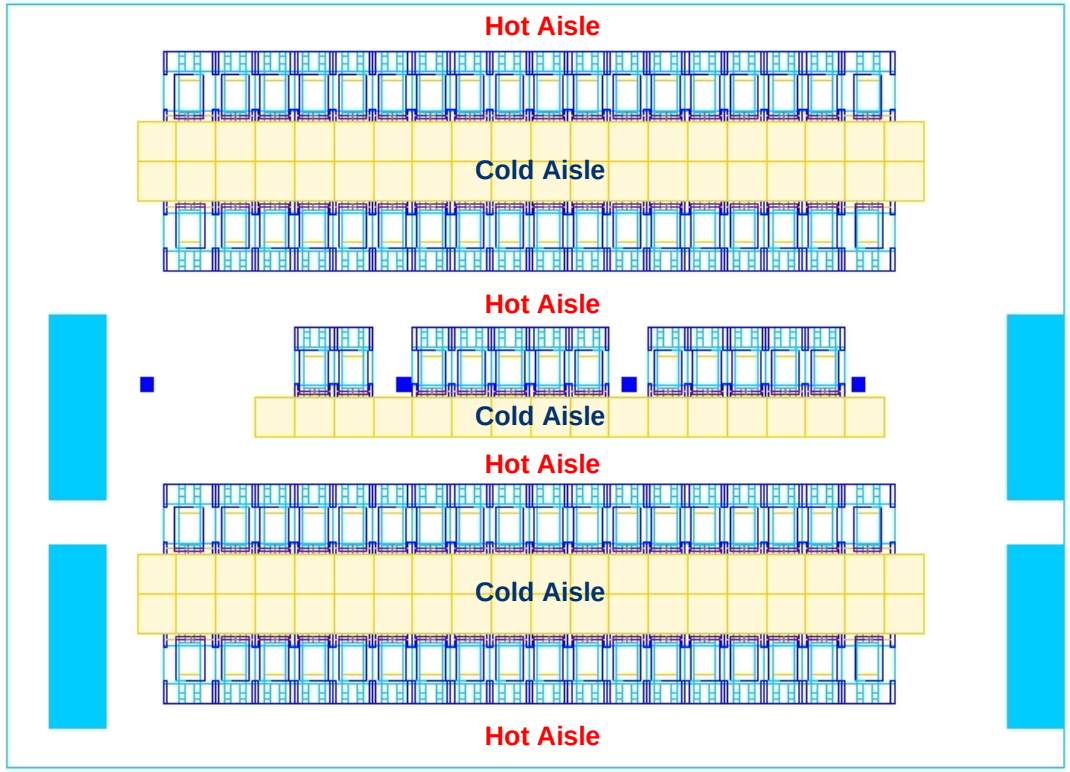
Case Study



Geometry:
Dimensions: 16.15m x 11.65m x 3.5m
Floor Area: 188 m^2
Floor Void Depth: 0.5m
Raised Floor to Ceiling: 3.0m

4 x 100kW AHU
Air Flow Rate:
16,000 CFM (7550L/s)
Supply Temp: 17.3degC

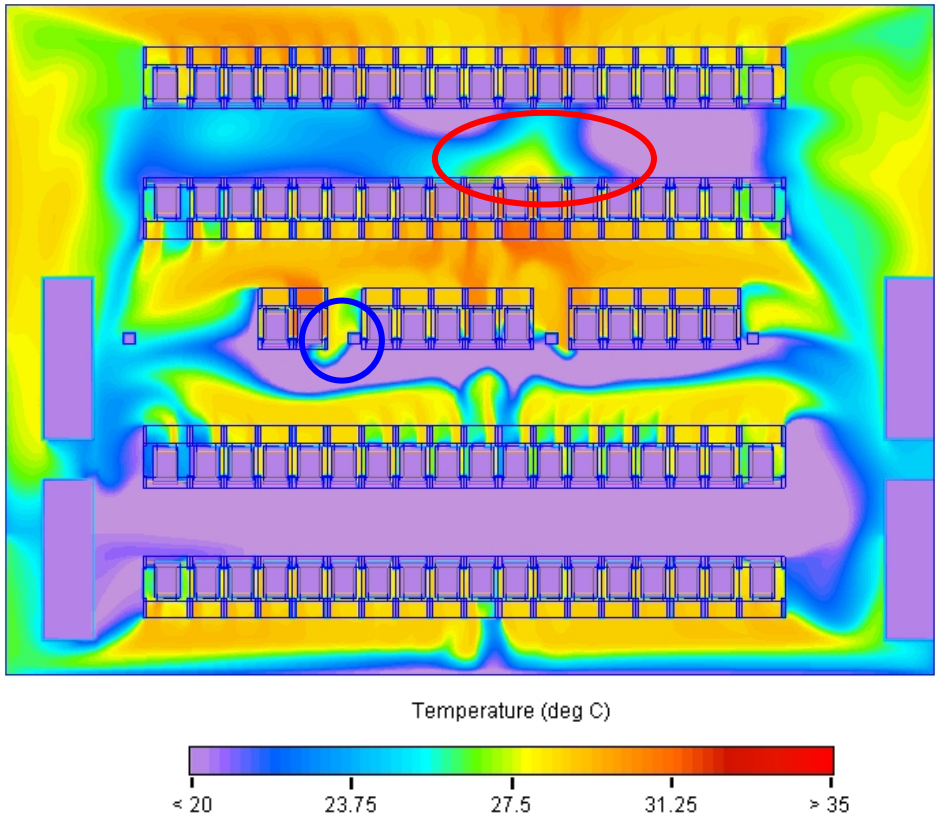
84 NetShelter VX racks
3kW Loading per rack
Server Air Flow Rate:
160 CFM /kW
75.5L/s per kW

96 Floor Tiles
40% Open Area Ratio

4 x Structural Columns

Phase1 Legacy Configuration

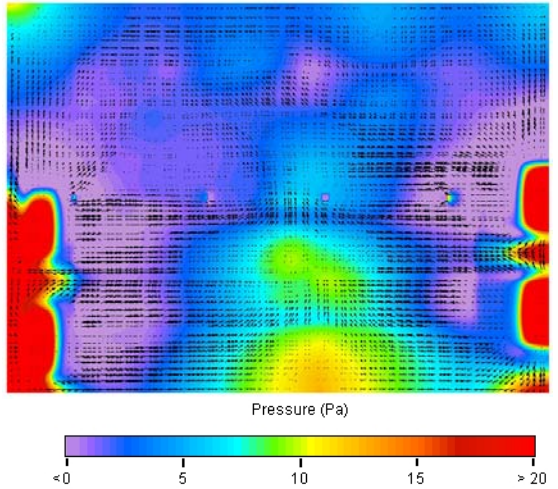
Temperature at 1.8m Above Raised Floor Level



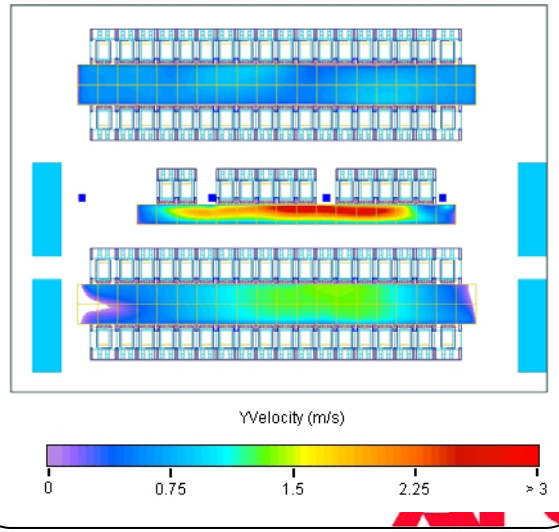
At 1.8m above raised floor level, some of the cabinets in the top two rows are seeing inlet temperatures of up to 28ºC.

Slight ingress of warm are is occurring through the gaps in the third row.

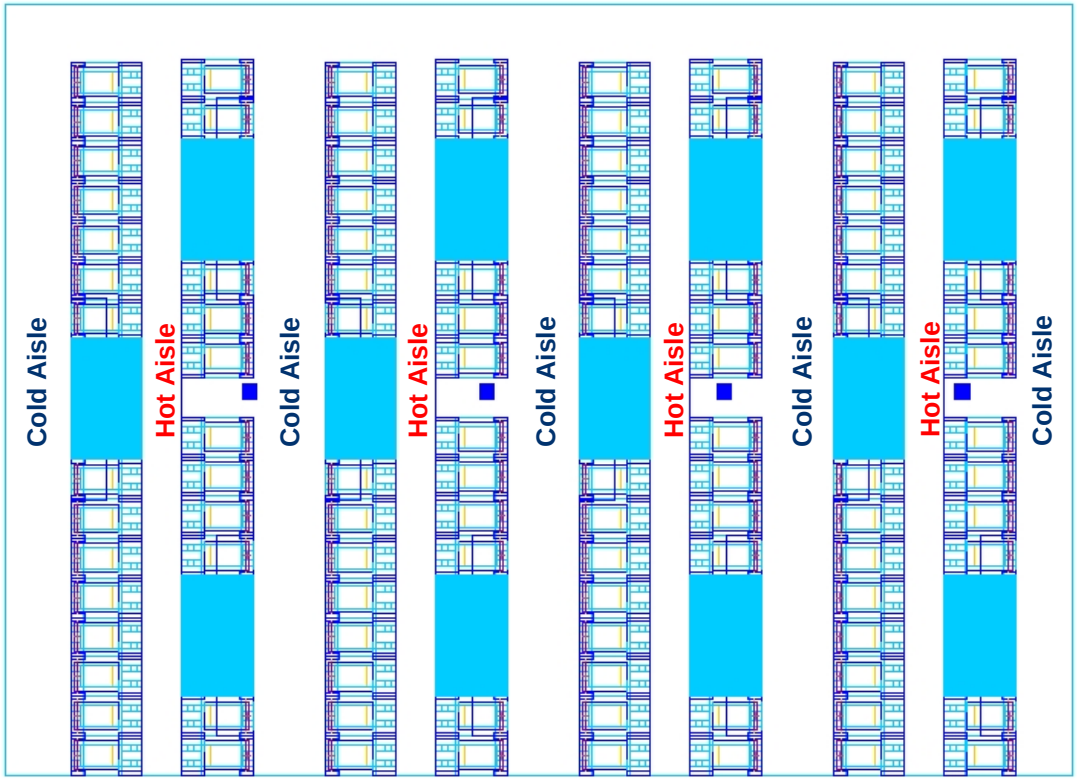
Void Pressure 0.25m from Floor



Y Velocity through Floor Tiles



Phase1 In Row Configuration



Geometry:
Dimensions: 16.15m x 11.65m x 3.5m

12 x FM IR units
Volume Flow Rate:
6,500CFM (3068L/s)
Supply Temp: 20.0degC

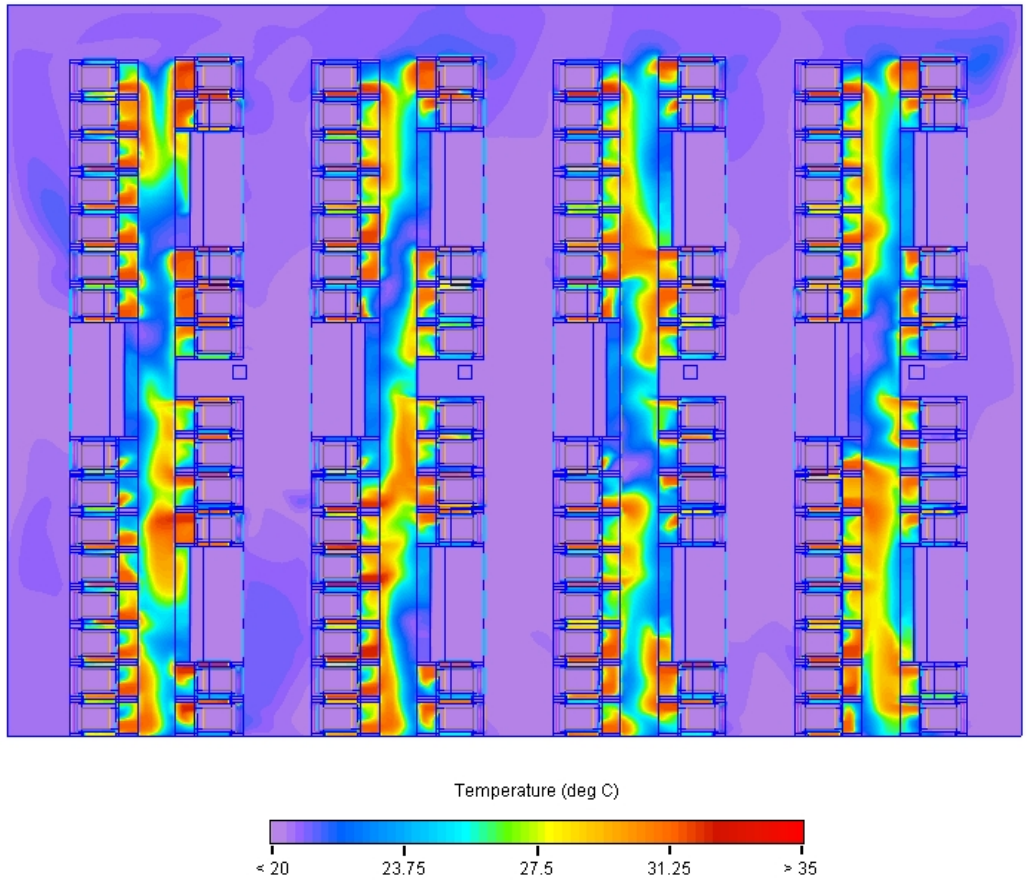
104 NetShelter VX racks
3kW Loading per racks
Server Flow Rate:
160cfm /kW
75.5L/s per kW

4 x Structural Columns

FM In Row design increases space utilisation to 104 racks

Phase1 In Row Configuration

Temperature at 1.8m

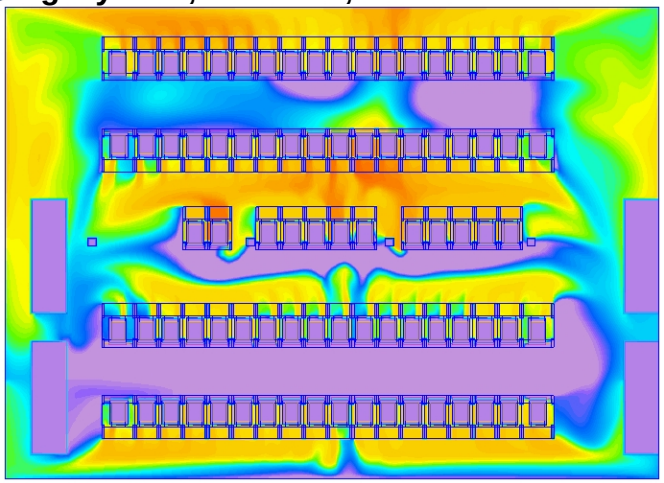


Very good containment is maintained across the entire room with maximum inlet temperatures at the tops of the cabinets reaching no more than 21°C.

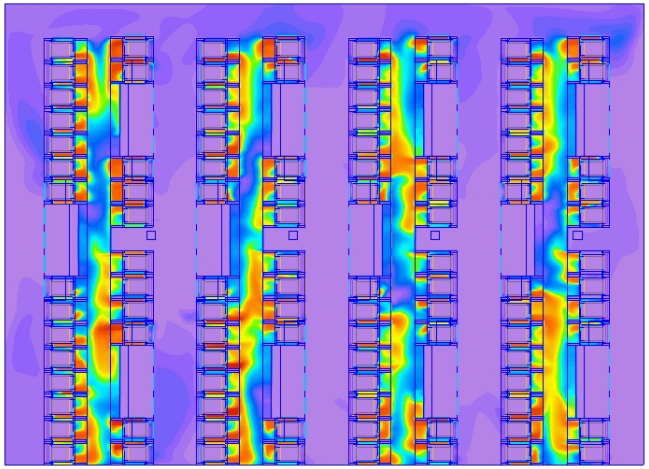
Phase1 Comparison Increased Load to 4.5kW per Cabinet

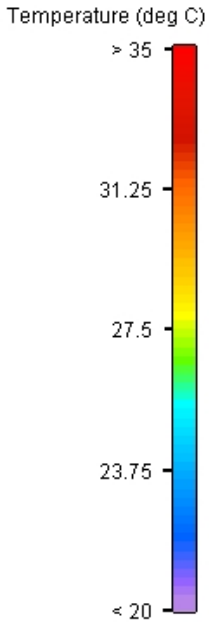
Temperature at 1.8m (42U)

Legacy 3kW, 84 Racks, Total Load = 256kW

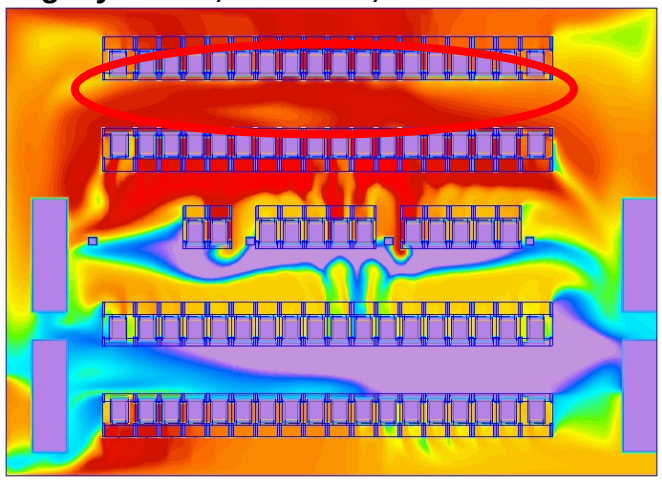


In row 3kW, 104 Racks, Total Load = 312kW

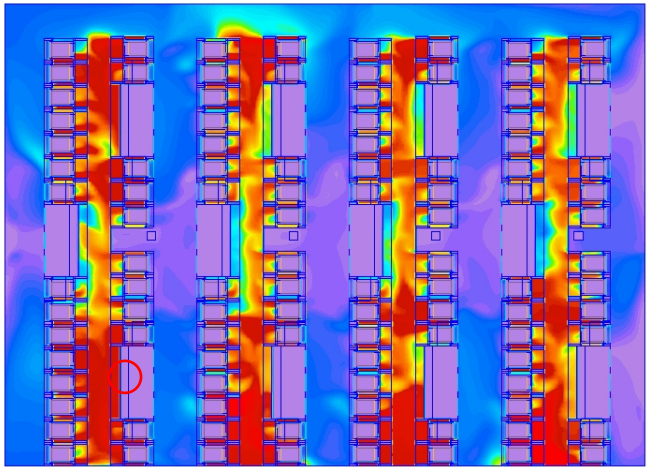




Legacy 4.5kW, 84 Racks, Total Load = 378kW



In Row 4.5kW, 104 Racks Total Load = 468kW



With increased loads of 4.5kW per rack, In Row systems cope extremely well with maximum inlet temperatures reaching around 24ºC. Legacy systems see temperatures exceeding 30ºC.

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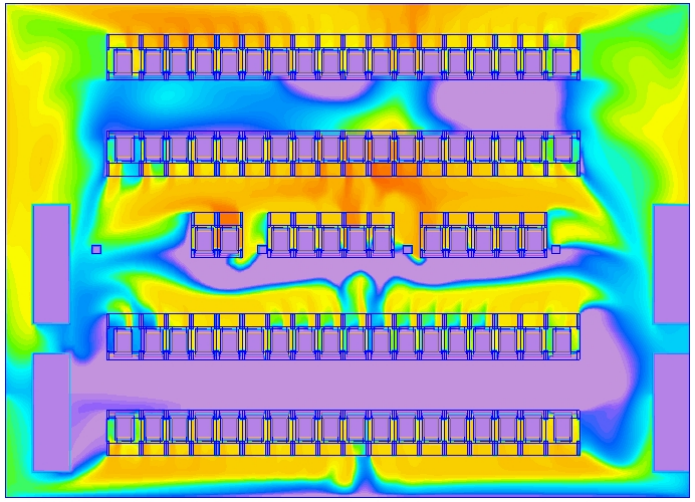
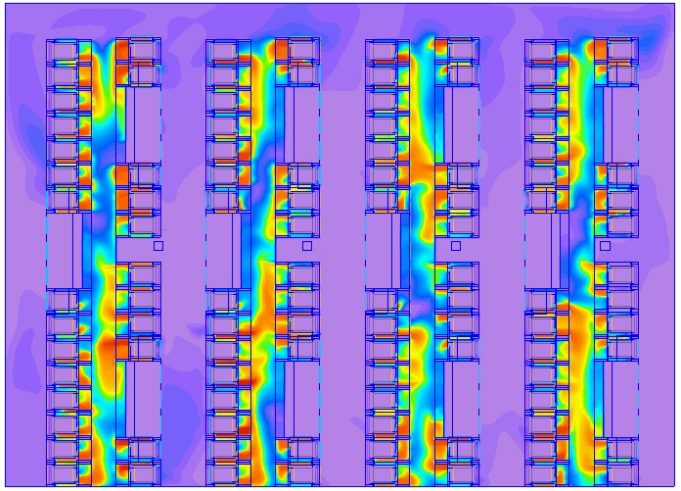
Phase1 Comparison N+1 Failure Scenarios at 3kW per Cabinet

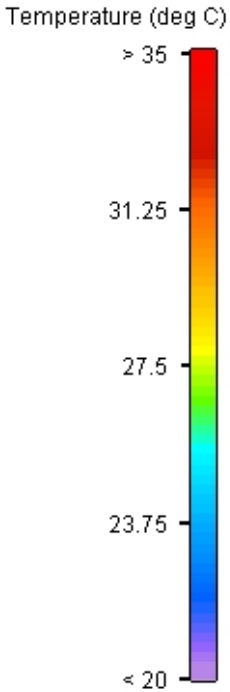
Temperature at 1.8m (42U)

Legacy 3kW, 84Racks, Total Load = 256kW

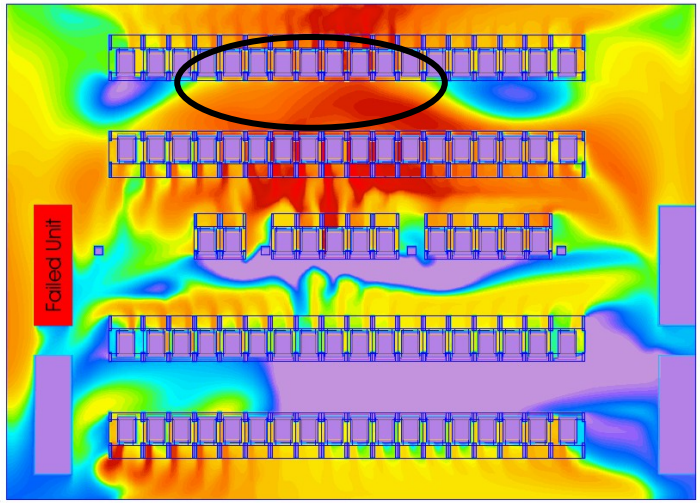


In row 3kW, 104 Racks, Total Load = 312kW



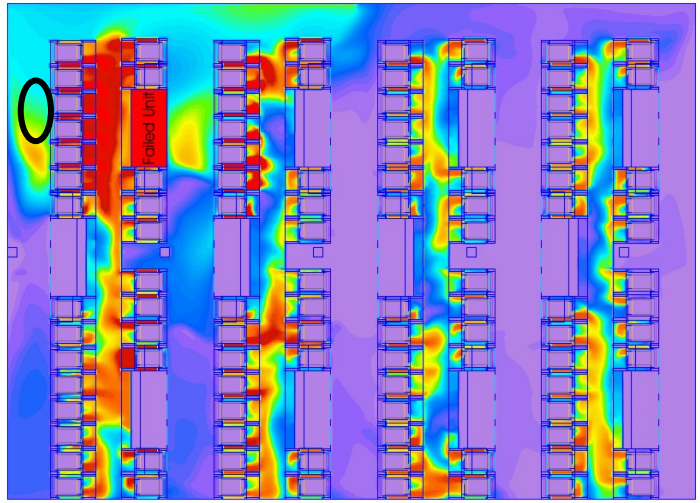


Legacy AHU Failure, 84 @ 3kW = 256kW



Inlet temperature >30°C

In row FM IR Failure, 104 @ 3kW = 312kW



Inlet temperature 26-27°C

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Conclusions

- **Blade servers and HD devices offer many benefits but draw from 2x to 5x the power when compared with older technology**
- **Keep the data center operating in optimum condition to avoid equipment failures, unexplained slowdowns and shortened equipment life**
- **Use new technology to keep HD racks cool.**