



Reducing Energy Consumption with Passive Cooling



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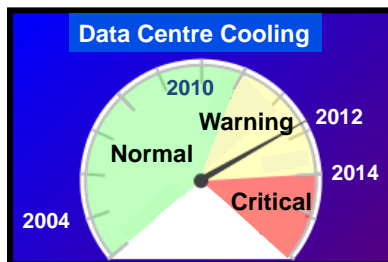
Reducing Energy Consumption with Passive Cooling

- Understanding Importance of Air Isolation
- Types of Air Isolated & Contained Solutions



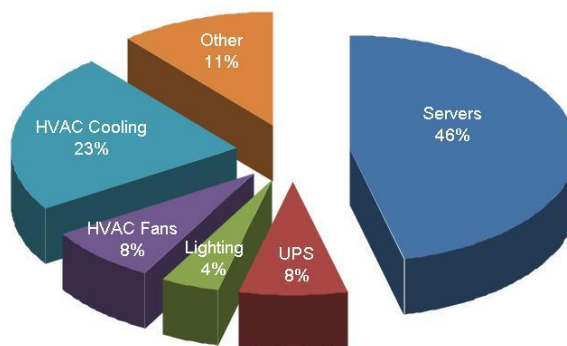
Data Centre Issues

- Data center heat loads are ever-increasing
- Power availability
- Spiralling energy costs
- Space is limited



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Average Data Centre Power Allocation



Average power allocation for 12 benchmarked data centers (LBNL).

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Mechanical Inefficiencies

Definition:

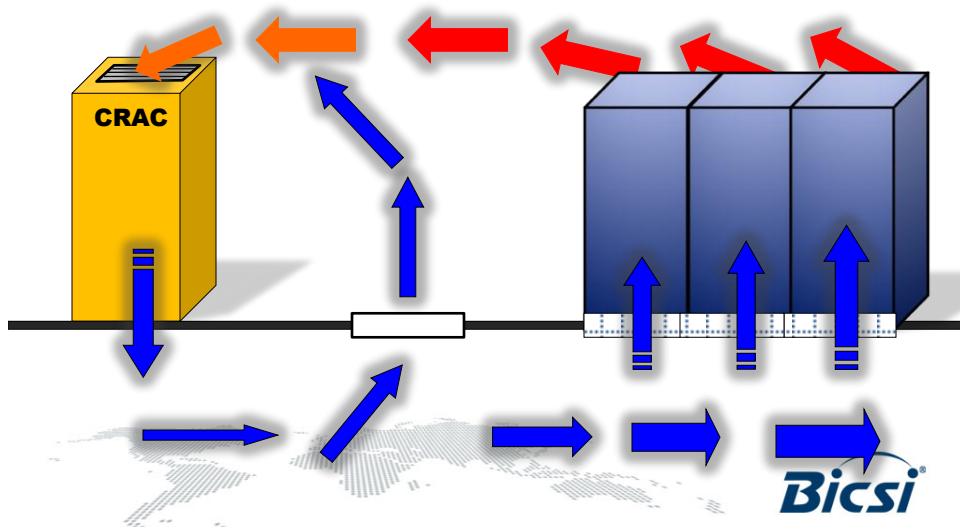
Bypass Airflow is when conditioned air is not getting to the intakes of the IT equipment

- 60% of the cool air cools the room but not the critical load except by recirculation
- Only 40% of cool air is supplied through cold aisle

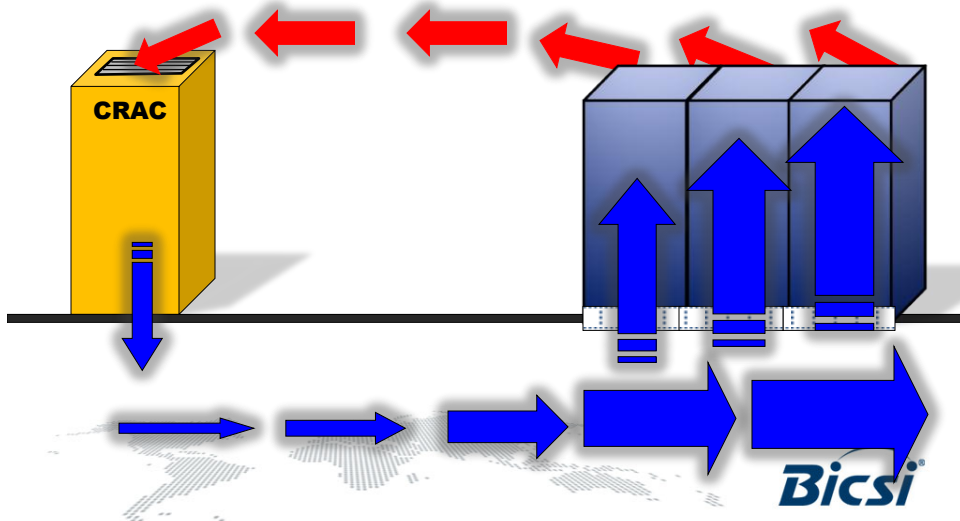


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With Bypass Airflow



Zero Bypass Airflow



Room Air Bypass and Re-Circulation

- Unsealed raised floor cable cut-outs cause bypass airflow
- Cool Air bypassed floor tiles re-circulates around room



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Mechanical Inefficiencies

- Considerations
 - Ease of use?
 - Requires policing?
 - Fire Rated?
 - Particulates?
 - Retrofit-able?
 - Static dissipation of raised floor?



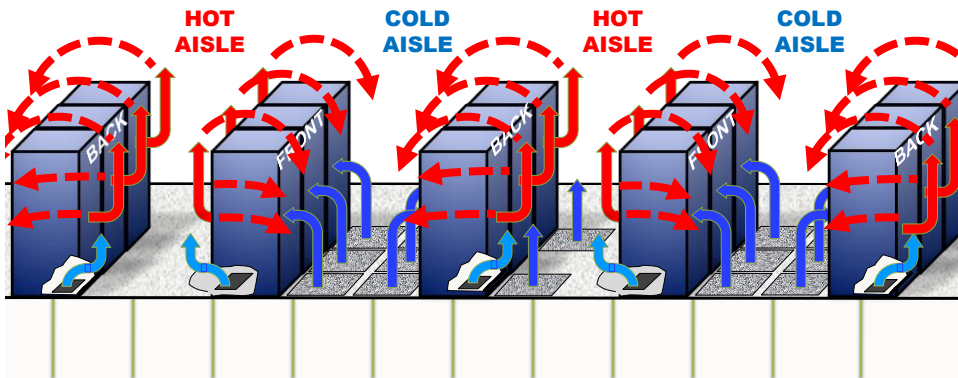
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Practical limitations of under-floor cooling

- Airflow through perforated floor tiles is limited
- Perforated floor tiles typically limited to 1189 CMH / 700 CFM
Approx 9kW for Blades and 4.5 kW for standard box servers
- Floor grates typically limited to 2379 CMH / 1400 CFM
Approx 18kW for Blades and 9 kW for standard box servers

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Hot Aisle / Cold Limitations



- Hot Air recirculation from the hot aisle into the cold aisle
- Bypass airflow under the cabinets
- Spot the mistake?

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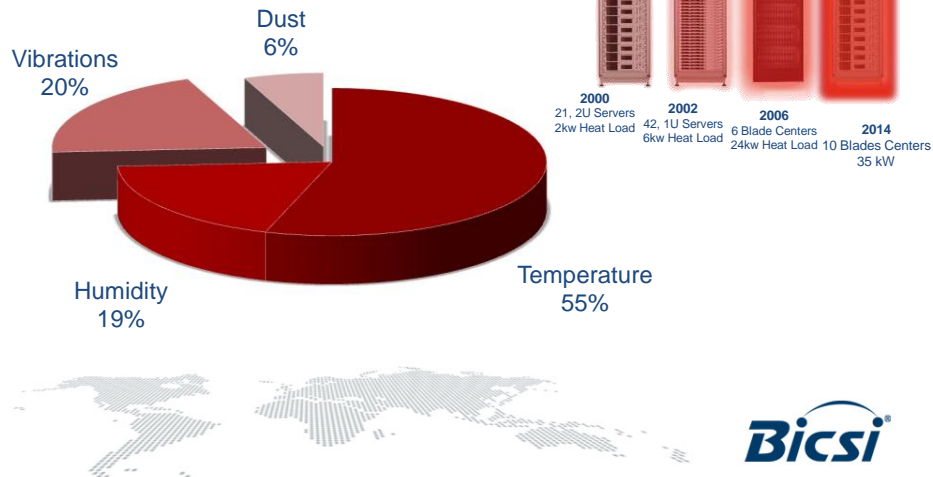
What Is The Target?

The latest ASHRAE recommended environmental envelope for Class 1 Electronics

	2004 Version	2008 Version
Low End Temperature	20°C (68 °F)	18°C (64.4 °F)
High End Temperature	25°C (77 °F)	27°C (80.6 °F)
Low End Moisture	40% RH	5.5°C DP (41.9 °F)
High End Moisture	55% RH	60% RH & 15°C DP (59 °F DP)

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The Major Cause of IT Failure?



Do I have a Hot-Spot?



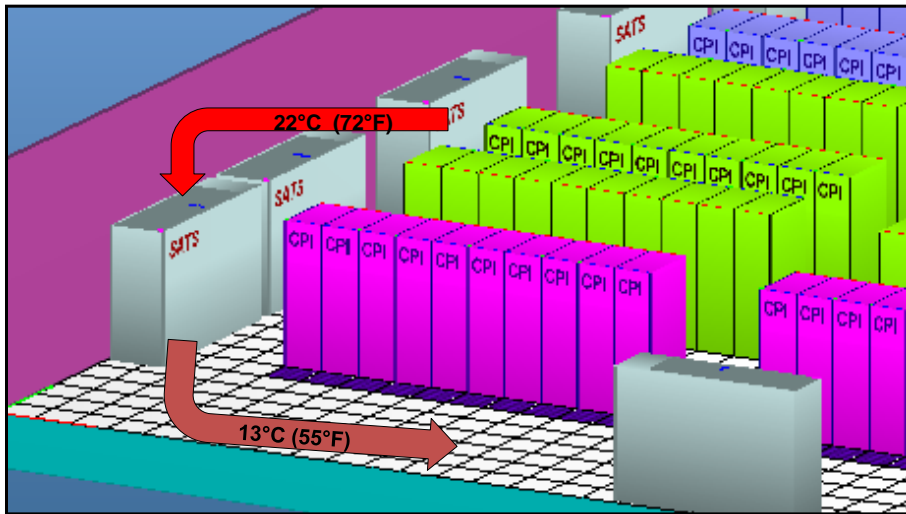
Strategically placed temperature strips can give a low cost visual reference

Use infrared thermometer to measure for hot spots – any point at air in-take over 27°C (80.6°F).

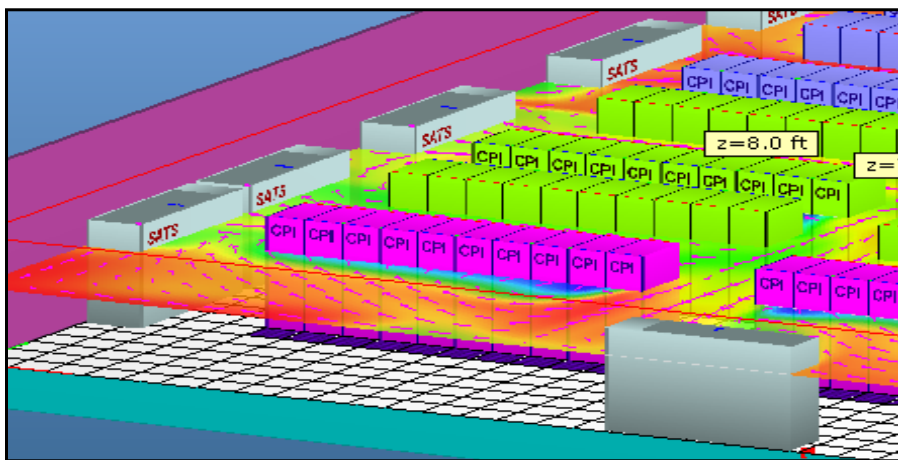
BICSI Measure directly at server in-take

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Typical Set Point Management?



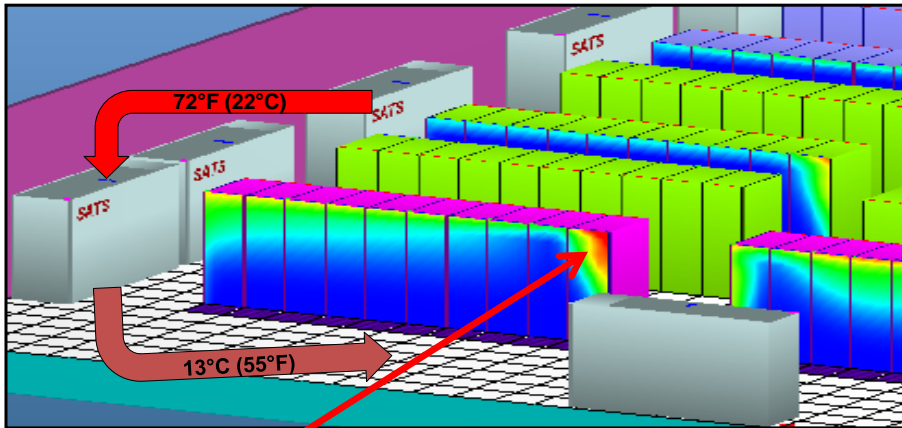
Typical Set Point Management?



Mixing of supply air and return air in typical data centre

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Typical Set Point Management?

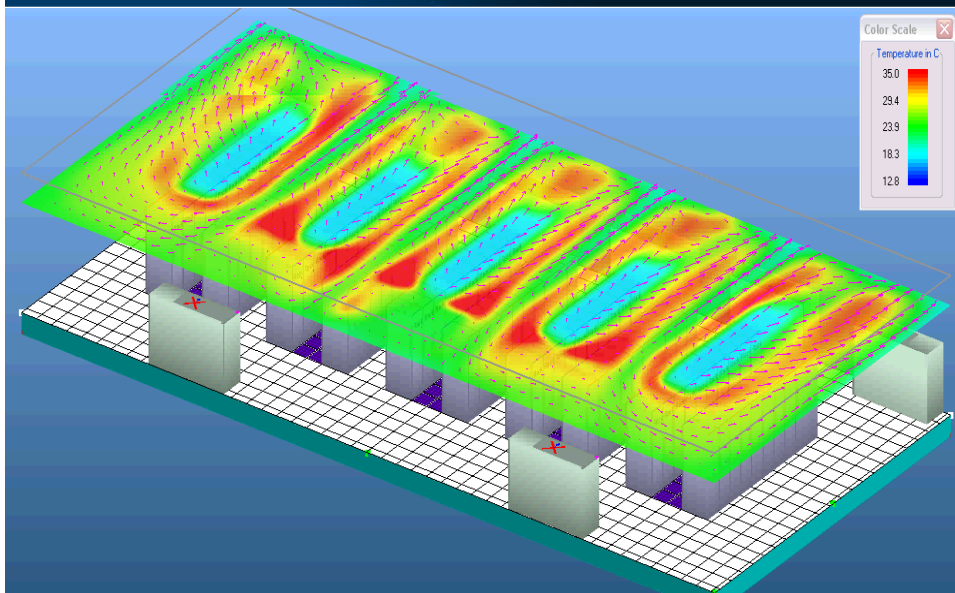


Result #1: Hot spots

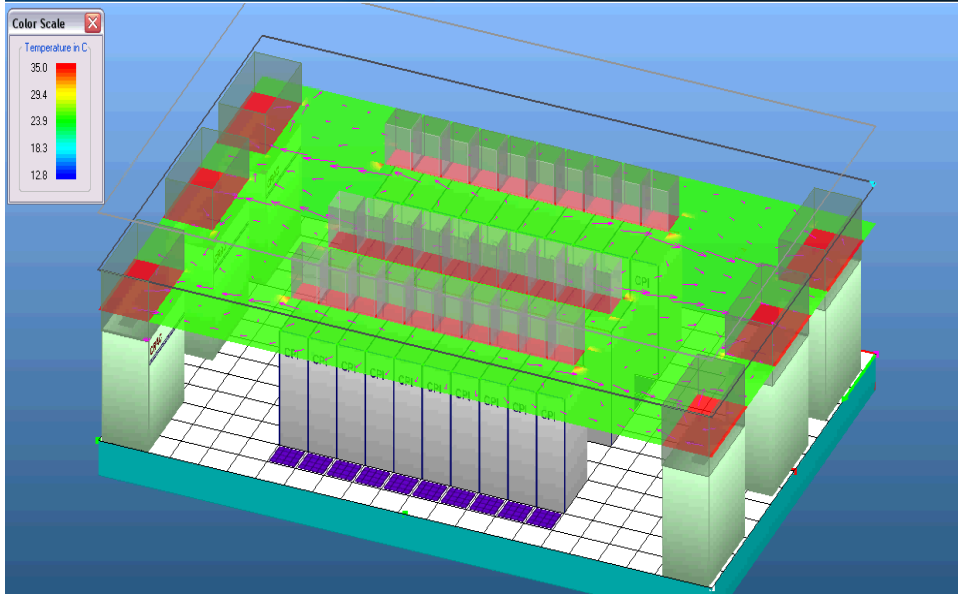
Result #2: Return air could cool a whole other data centre

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Mixed Environment



Contained or Isolated Environment



Reducing Energy Consumption with Passive Cooling

- Understanding Importance of Air Isolation
- **Types of Air Isolated Containment Solutions**



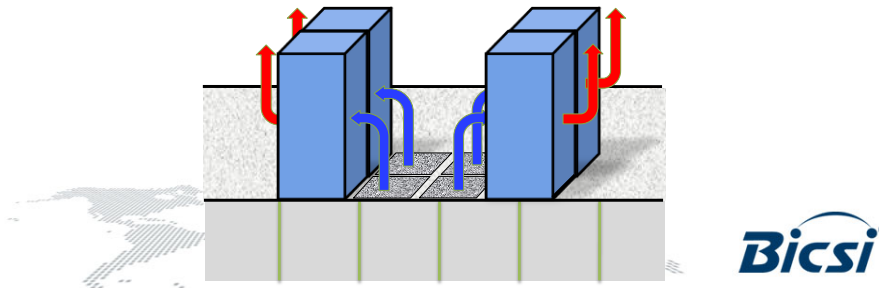
Planning For Data Centre's

A change of thinking . . .



Why is the cabinet important?

The cabinet is the **architectural feature** in the data centre **that secures** the **isolation** between supply air and return air



Planning For New Data Centre's:



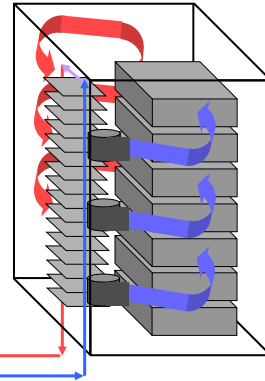
Water is 3467 times more efficient than air in removing heat



Water Cooled Cabinets

- Benefits

- Cooling directly at the cabinet
- Doesn't require air distribution underneath a raised floor
- Can be scaled to kW of cabinet load
- Isolates hot air from cool air

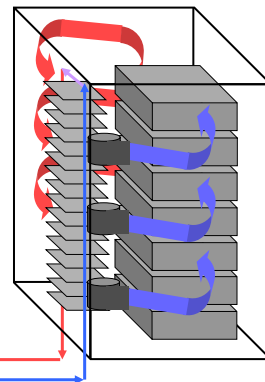


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Water Cooled Cabinets

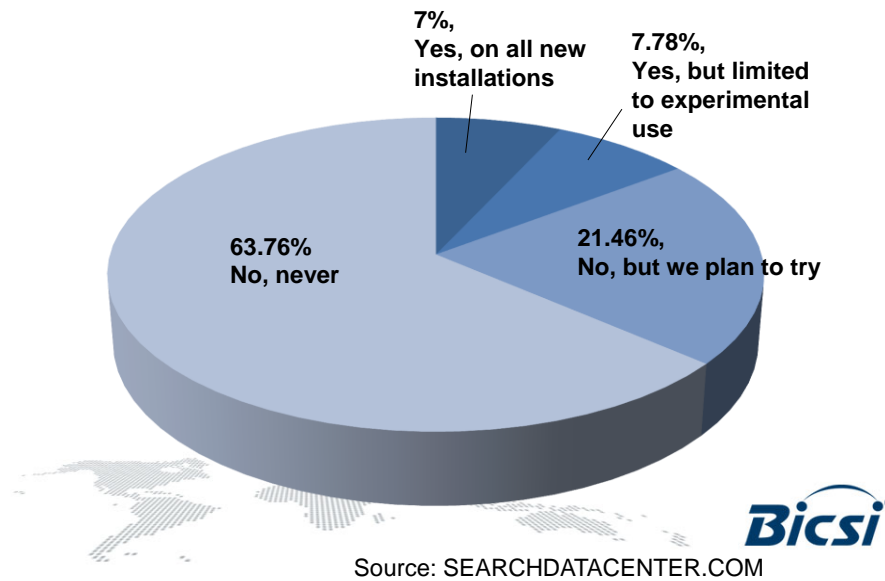
- Negatives

- Complicated
- Coolant lines in data centre
- Multiplies the possible points of failure
- Lifespan on components = redundancy plan
- Costly
 - Both cabinets & construction costs
 - Operating costs
 - Service



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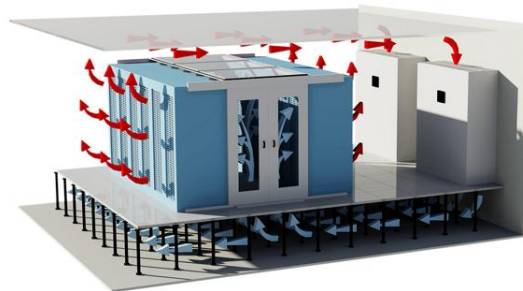
Water Cooled Cabinets



Cold Aisle Containment

Benefits

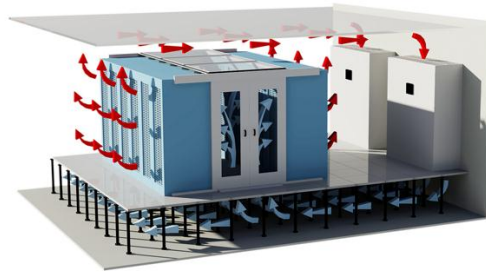
- 100% Utilization
- Provides uniform cool air to equipment
- Isolates hot air from cool air
- High Return Temperatures
- Low cost of ownership



Cold Aisle Containment

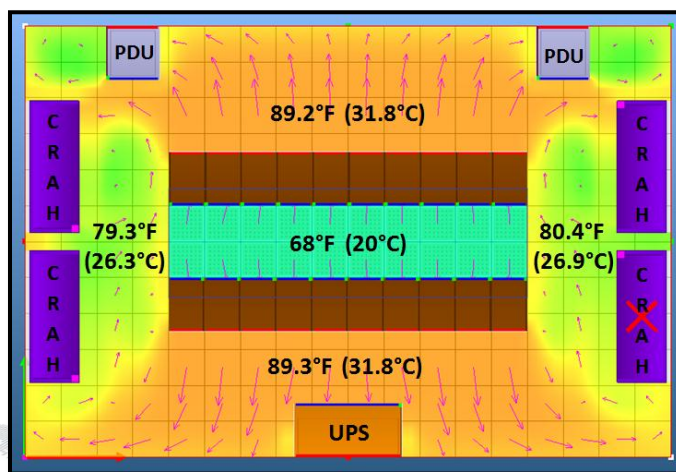
Negatives

- Redundancy planning (Thermal Mass)
- Room temperature is uncomfortable & air turbulence
- Must be installed in rows
- Dependant on raised floor
- Temperamental pressure level under floor and in CAC



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Cold Aisle Containment

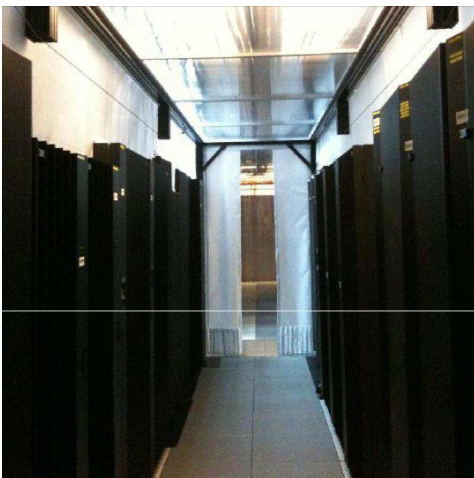


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Cold Aisle Containment



Cold Aisle Containment

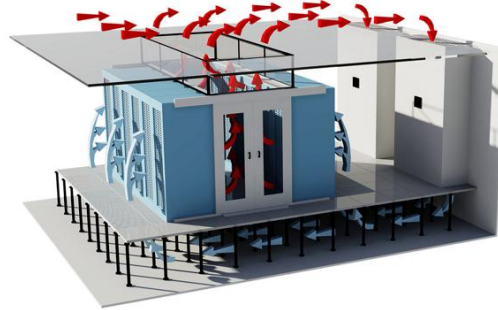


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Hot Aisle Containment

Benefits

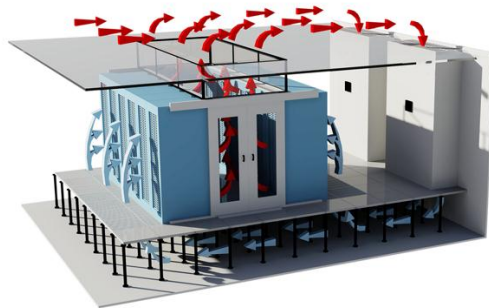
- 100% Utilization
- Higher Thermal Mass
- Comfortable Room
- Not dependant on raised floor
- High Return Temperatures



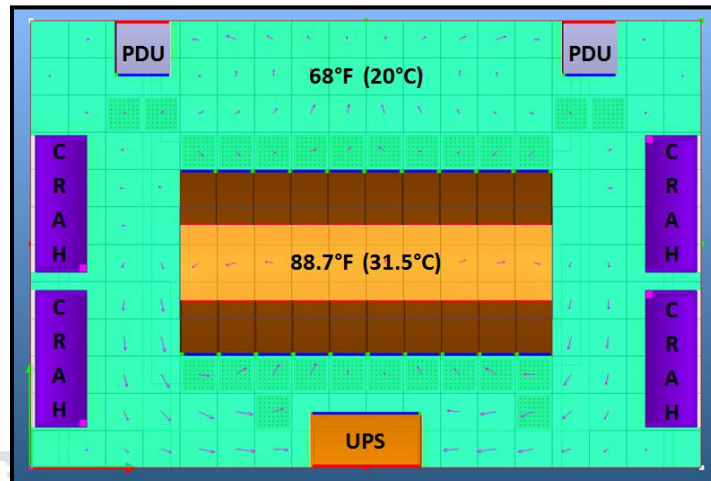
Hot Aisle Containment

Negatives

- Hot Aisle temperature is uncomfortable & air turbulence
- Must be installed in rows
- Ducting is required
- Must plan ahead
- Expensive



Hot Aisle Containment



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Hot Aisle Containment



Chimney Cabinets

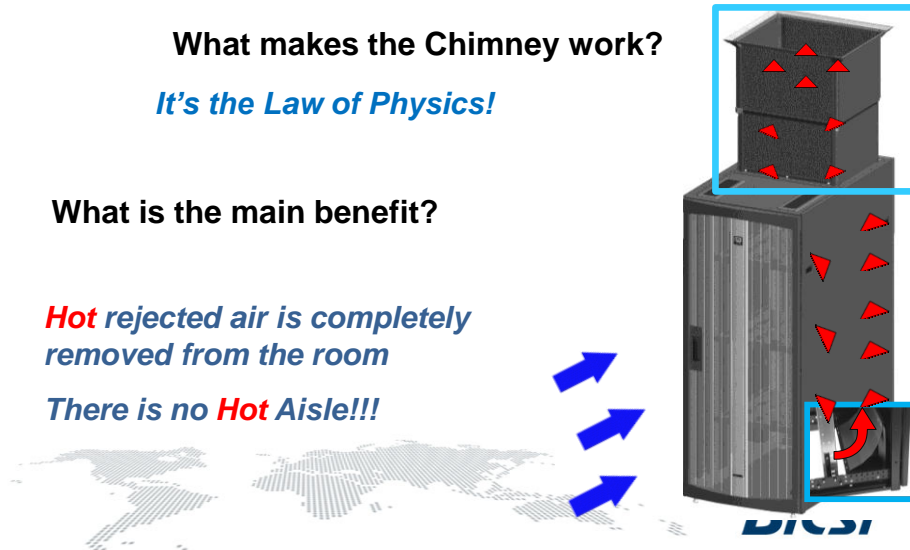
What makes the Chimney work?

It's the Law of Physics!

What is the main benefit?

Hot rejected air is completely removed from the room

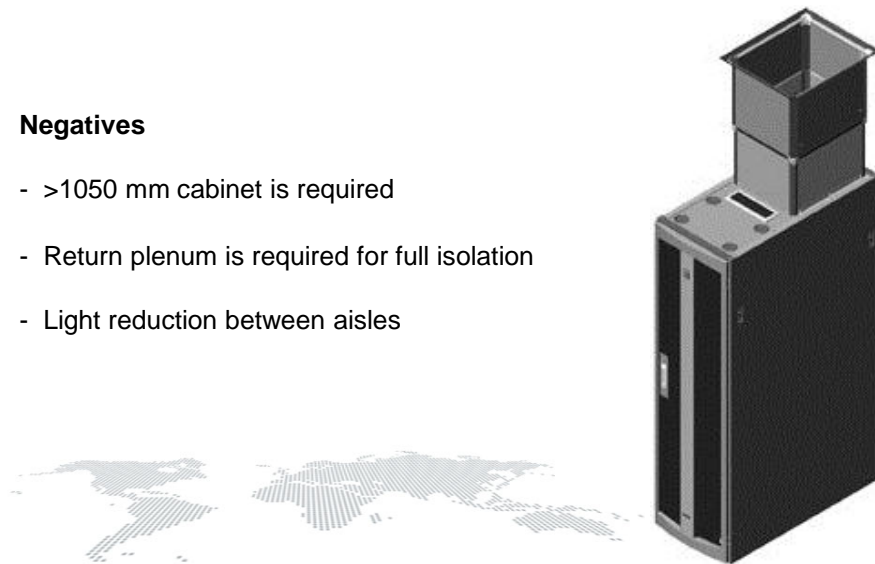
There is no **Hot** Aisle!!!



Chimney Cabinets

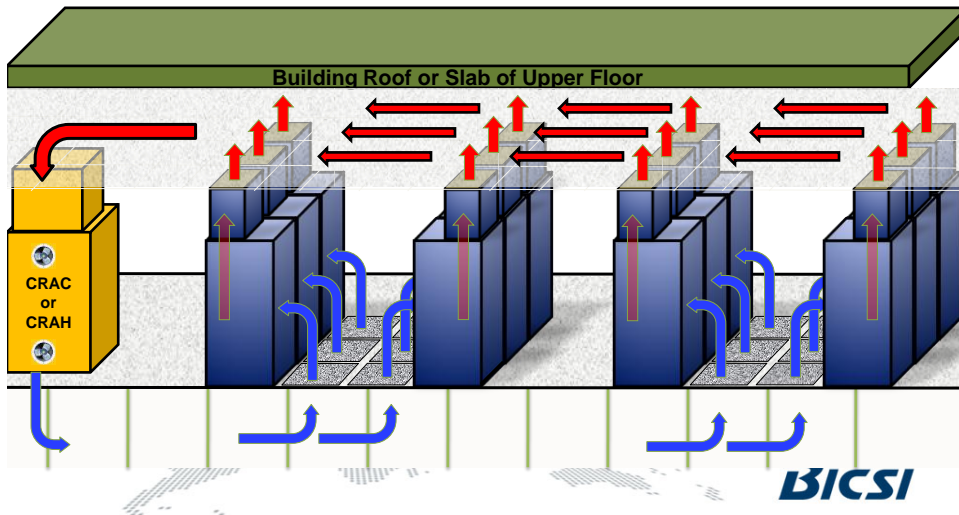
Negatives

- >1050 mm cabinet is required
- Return plenum is required for full isolation
- Light reduction between aisles



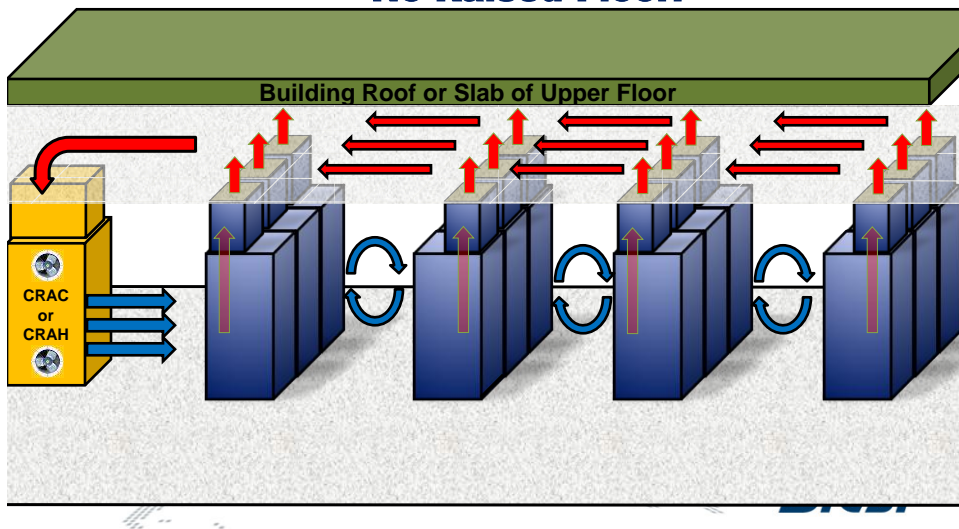
Chimney Cabinets

How does it look on a Raised Floor Plenum?

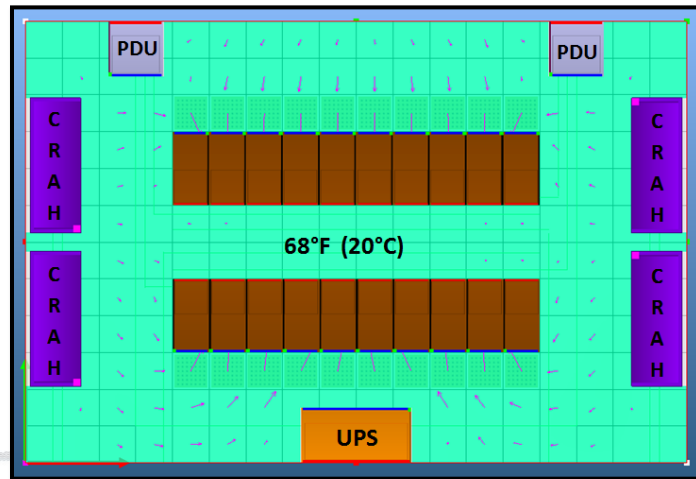


Chimney Cabinets

No Raised Floor!



Chimney Cabinets



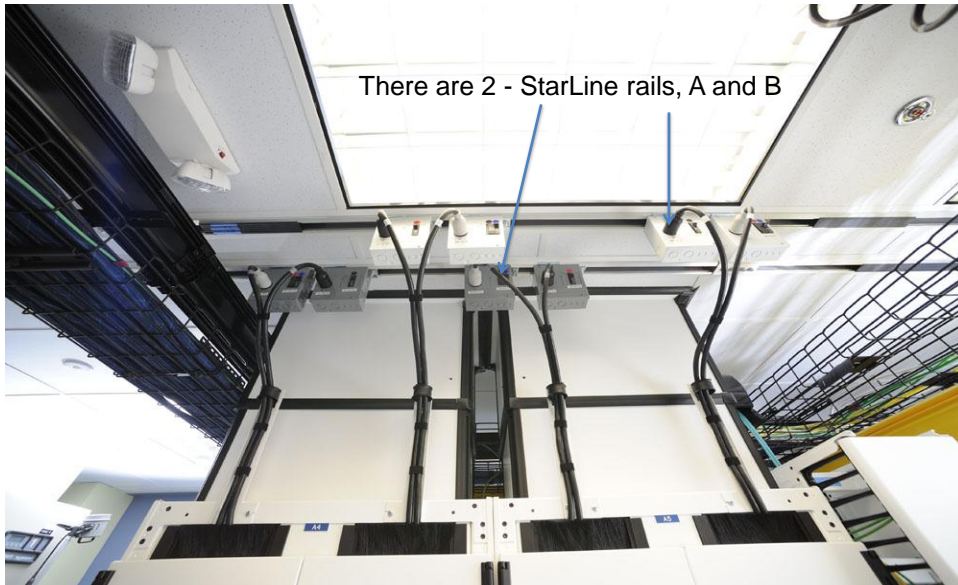
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Chimney Cabinets




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Chimney Cabinets







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All Ca


- 19" Filler Panels



- Air Dam Kit



25 mm rail set-back = 5+ U open s

What Is the Best Containment?

DataCenter 2020: Hot-aisle and Cold Aisle Containment Efficiencies Reveal No Significant Differences

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The DataCenter 2020 is a joint T-Systems and Intel data center test laboratory in the Munich-based Euroindustriepark.

www.datacenter2020.com



Summary

- Heat loads in the data centre are rising
- Existing data centers can be improved now by isolation
- **Green** strategies are good for the environment & the corporation
- Do your Home Work!!!!



Thank You!



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