



Ken Koty

Ken's Korner

AIRFLOW MANAGEMENT

ASSESSING & ADDRESSING AIRFLOW PROBLEMS

Types of Airflow Problems

- Hot spots – an area, related to a rack or set of racks, where ambient air temperature is above acceptable levels. Typically caused by poor airflow management (insufficient cool air supply or an excess of recirculation).
- Air leaking – commonly occurs when air passes through penetrations in walls and floors by pipes, pillars and other utilities. The accumulation of these penetrations can lead to significant loss of air pressure and cooling capacity. Excess air pressure can contribute to this problem.
- Air mixing – the unintended mixing of cold and hot air. Uneven air pressure between a hot and cold aisle causes cold air to leak into the hot aisle bypassing servers.
- Recirculation – when servers need more cold air than is being supplied, hot air will recirculate from the back of a server (hot aisle) to mix with the cold air in the front of the server (cold aisle).
- Short-circuiting - when hot air does not return directly to the CRAC unit.
- Obstructions & air dams – abandoned cables and cables running in cold aisles under a raised floor can create obstructions limiting airflow to perforated tiles. Piping, cable trays or electrical conduit in overhead applications can also cause obstruction and air dam problems in overhead air returns.
- Negative airflow – when under floor air velocity is significantly greater than the return air flow, room air will be drawn down into perforated floor tiles and mixed into the cold air discharged from the CRAC unit. This can happen when placing perforated tiles too close to an CRAC unit.

Maximize cooling efficiency by retrofitting a legacy data center with airflow management techniques designed to reduce cooling energy costs and increase equipment density capacity.

Identifying or Assessing Airflow Problems

- When measuring server temperatures, measure at both tops and bottoms of racks or cabinets to gauge the change in temperature from top to bottom.
- Measure temperatures with thermometers; while infrared scanning is helpful to gauge surface temperatures when identifying hot spots, a thermometer will provide a truer ambient temperature.
- Measure temperatures at 3 or 4 server locations for every CRAC unit in place.
- Temperature measurements should be made from several aisles, and locations within an aisle.
- When measuring air temperatures try to measure air temp as close to the air inlet and outlets of the servers without touching any surfaces.
- When measuring inlet and outlet temperatures, measure both from the same piece of equipment to maintain consistency, and repeat from the different locations throughout the floor.
- When taking temperatures throughout the data center remember to document those locations, so you can revisit those locations later and verify the impact of making changes.
- Make sure that IT informs you if they install additional servers within cabinets which will increase heat load.

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AIRFLOW MANAGEMENT

ASSESSING & ADDRESSING AIRFLOW PROBLEMS (CON'T)

Fundamental Steps to Improve Airflow

- Seal underfloor air leakage at cable and pipe penetrations, especially along walls and under racks and cabinets.
- Consolidate cable penetrations to reduce air leakage.
- Relocate floor tiles to balance underfloor airflow and eliminate hot spots.
- Eliminate floor openings in hot aisles or other areas where cooling isn't required.
- Fix or replace leaking or broken floor tiles.
- Make sure air velocities from floor tiles are adequate to supply cool air to the tops of the racks and cabinets.
- Make sure air velocities from floor tiles aren't so high the cool air overshoots the top of the racks and cabinets.
- Remove or relocate as many underfloor airflow obstructions as possible.
- Install blanking panels into openings in cabinets where equipment is missing.
- Employ a hot aisle/cold aisle configuration, making sure equipment exhausts into a common hot aisle separated from the cold aisle where cool air is supplied to equipment air intakes.
- Close gaps between cabinets where warm air is recirculating back into the cold aisle.
- Add side panels to racks and cabinets that are allowing free airflow between hot and cold aisles.
- Consider flexible strip curtains to physically separate hot and cold aisles above equipment to prevent recirculation and direct hot air into overhead air returns.
- Rigid enclosures can be used to create a cold aisle containment system.

- Make sure IT equipment utilizes a front-to-back cooling airflow configuration.
- Make sure equipment is configured to discharge heat away from other equipment air intake.
- Select and use racks and cabinets with an internal structure with limited obstructions permitting maximum airflow.
- Locate higher density racks closest to CRAC units and verify airflow effectiveness.
- Locate servers to minimize vertical and horizontal empty space in racks.
- Load racks bottom first in racks based on cooling needs.
- Match underfloor airflow to IT equipment needs.
- Inspect, clean or replace dirty CRAC/CRAH unit filters and A coils. Check for worn or loose blower fan motor belts.

Intermediate Steps to Improve Airflow

- Determine chiller and cooling tower system capacity.
- Study airflow patterns with virtualization testing tools.
- Observe thermal profiles above and below the floor using heat mapping.
- Install a dropped ceiling and duct hot air away from electrical equipment.
- Consider creating an overhead return hot-air plenum.
- Extend CRAC air intakes into overhead hot-air return plenum.
- Install isolation dampers in air intake ductwork.
- Install hot and cold aisle isolation systems (curtains).
- Install and use temperature sensors to measure airflow temperature at server inlets.

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