VERTIV.

Overview

The foundation of data center airflow management is the Hot Aisle-Cold Aisle design, where cabinets are placed in alternating rows, with IT air intakes (cold aisles) and IT air exhausts (hot aisles) each facing one another. This configuration allows data center operators to focus cooling airflow only where it's needed—the IT air intakes—and to avoid unnecessary cost and inefficiencies from conditioning the entire whitespace.

A key assumption underlies the hot aisle-cold aisle configuration: that all IT equipment breathes in a front-to-back fashion. That is, cool air enters the equipment in the front, picks up heat from the internal components, and exits out the back at a warmer temperature. This is predominantly true for most hardware.
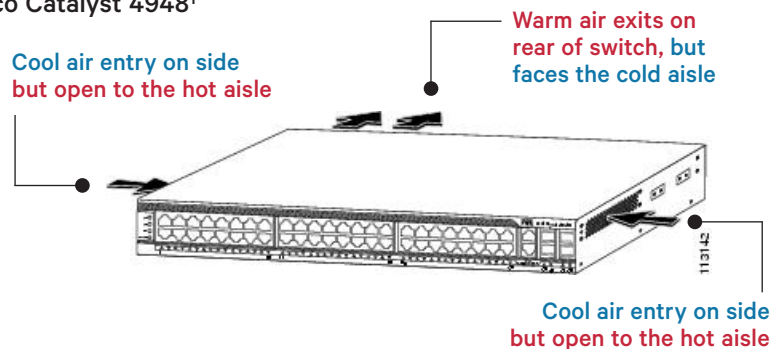
Terminology:

- **Active SwitchAir**
  Uses embedded fans to pull air into the SwitchAir chassis and channels, where it's funneled to switch air inlets.

- **Passive SwitchAir**
  Provides a channel to funnel cooling air volume to the switch inlets, while also preventing exhaust air from entering switch.
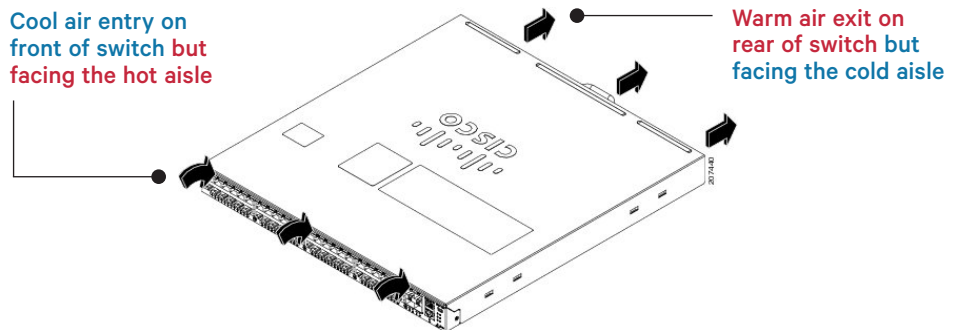
Challenge

A particular class of hardware—network switches—has challenged airflow conventions for a number of years. Network switch airflow patterns can vary considerably depending on manufacturer, model, and configuration. Consider the following images provided by Cisco—one of the preeminent vendors of networking hardware, detailing the possibilities with a Catalyst 4948. In these examples, we see three airflow paths for the same product family:
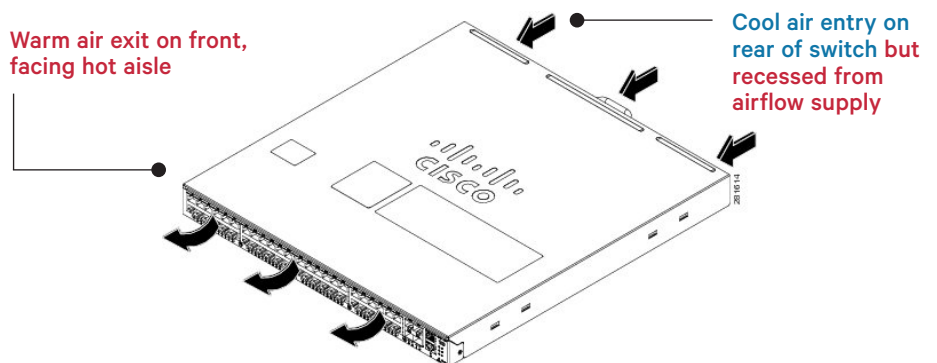
1. Cisco Catalyst 4948[1]

Cool air entry on side but open to the hot aisle

Warm air exits on rear of switch, but faces the cold aisle

Cool air entry on side but open to the hot aisle

2. Cisco Catalyst 4948E[2]

Cool air entry on front of switch but facing the hot aisle

Warm air exit on rear of switch but facing the cold aisle

2. Cisco Catalyst 4948EF[3]

Warm air exit on front, facing hot aisle

Cool air entry on rear of switch but recessed from airflow supply

In the mid-2000s, this dialogue centered on large side-breathing core switches, which were generally limited to only certain areas of the data center whitespace. Today, while these large core switches are still equally present and important, they are often complemented by many top-of-rack switches (abbreviated TORS), installed at the topmost rack spaces. The TORS provide facilitates shorter cable runs and has become a popular approach in data center deployments.
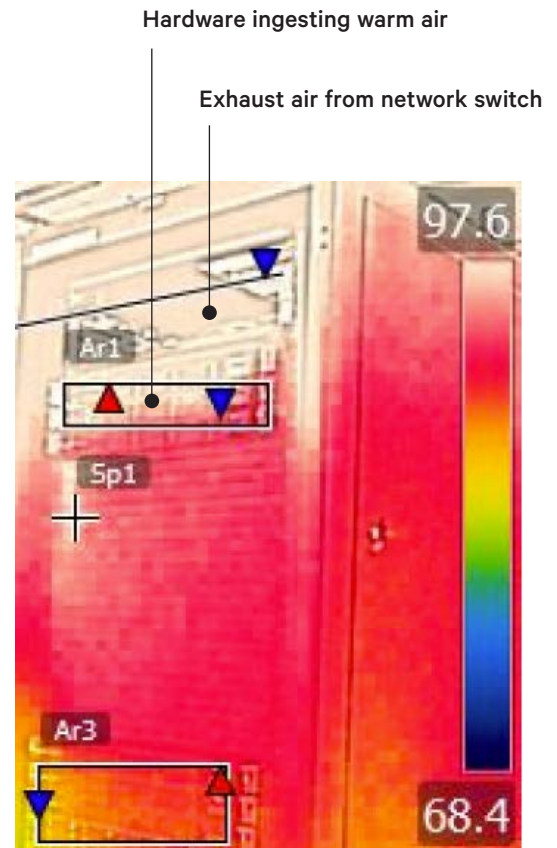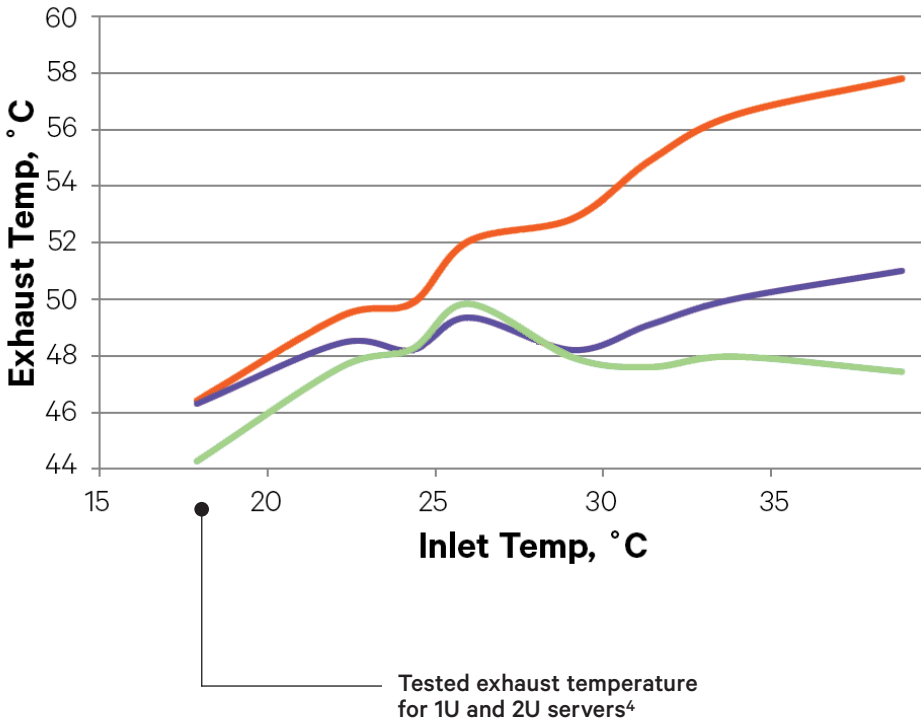
But depending on the choice of TORS, there can be many potential conflicts to the Hot Aisle—Cold Aisle topology throughout the data center. In the infrared image below, a top-of-rack switch is exhausting hot air into the cold aisle, presenting two problems:

1. It exacerbates existing thermal problems: there's not enough cooling airflow at this rack location. The server directly below the switch exhaust is an example of this condition.

2. Based on the exhaust pattern, this switch has cooling air inlets either on its sides or its front (with the actual ports). These locations are closest to the hot aisle. Thus, the cooling airflow for the switch is the exhaust air of all the other devices.

If the switch continually receives cooling airflow beyond its tolerances, its useful life could be cut short or it may fail unexpectedly. The chart below, provided by Dell, plots server exhaust temperatures based on varying cooling airflow temperatures. These exhaust temperatures can become the "cooling airflow" for the switch.

Tested exhaust temperature for 1U and 2U servers[4]

Hardware ingesting warm air

Exhaust air from network switch

The Vertiv Geist Solution: SwitchAir Side, Front or Rear Intake

The SwitchAir complements the data center's existing cooling supply, providing a channel for the conditioned air to travel to the hard-to-reach inlets of a top-of-rack switch (TORS). Despite having suboptimal placement in a cabinet, a switch needs to benefit from the same cooling airflow as the rest of the hardware. The SwitchAir makes that a reality with two options for users to choose:

- An Active SwitchAir that uses embedded fans to pull air to and through the switch inlets

- A Passive SwitchAir that channels cool air to and through the switch inlets and prevents hot air exhaust from entering the switch

Side

The available SwitchAir side-intake part numbers are detailed in this table:

Geist Part Number	Switch Type	Air Intake Locale	Mode	Height
SA1-01001NB	TORS	Side	Passive	1U
SA1-01001SS	TORS	Side	Passive	1U
SA2-002	TORS	Side	Active	2U
SA2-003	TORS	Side	Active	2U
SA2-006	TORS	Side	Active	2U

Front

The SwitchAir mate for front intake (port-side) switches is Geist part number SA2-004, which is detailed in the table and image below. SA2-004 is an active model, using a fan to pull cooling airflow to the hot side of the cabinet where it's consumed. The SwitchAir fan consumes a modicum of power (15W) to deliver this cooling airflow. The SwitchAir models for front-intake switches are detailed in the table below:

Geist Part Number	Switch Type	Air Intake Locale	Mode	Height
SA2-004	TORS	Front	Active	1U

Rear

The SwitchAir models for rear-intake switches are detailed in the table below:

Geist Part Number	Switch Type	Air Intake Locale	Mode	Height
SA1-01002	TORS	Rear	Passive	1U
SA1-01002L	TORS	Rear	Passive	1U
SA1-01002S	TORS	Rear	Passive	1U
SA1-01002XS	TORS	Rear	Passive	1U
SA1-01002XLNB	TORS	Rear	Passive	1U
SA1-02003L	TORS	Rear	Passive	2U
SA1-02003	TORS	Rear	Passive	2U
SA1-02003S	TORS	Rear	Passive	2U

Installation

In most cases, the SwitchAir will be deployed to solve a problem: a switch that is constantly ingesting warmer air than it should. Accordingly, it's important that the SwitchAir is retrofit-friendly.

The SwitchAir channels become an extension of the switch's native mounting kit, which is generally only connected to the rear set of 19" rails. By installing around this kit and extending its reach to the front 19" rails, the SwitchAir can access cooling airflow from the cold aisle supply.

Cisco 4948 with SwitchAir   Cisco 4948 without SwitchAir
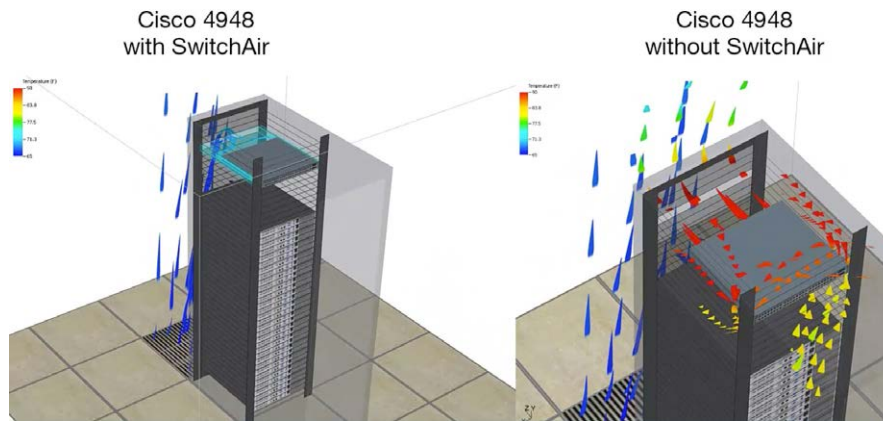
Will It Fit?

In a word, yes. The SwitchAir Finder, available on **Vertiv.com**, is a comprehensive resource with over 350 unique switch part numbers to match the right SwitchAir with your network switch model(s).

The diagram illustrates cool air intakes on both sides with a rear exhaust toward the cold aisle. Upon selecting the Cisco 4948 model, the finder reveals the SwitchAir match validating the side intakes and rear exhaust configuration.

Use the SwitchAir Finder to locate the Geist SwitchAir that you require based on a variety of configuration options. Suggested devices for individual switches are based on combinations of manufacturer specifications, end user recommendations, CFD modeling and customer requests. Assumptions are made that switches are primarily mounted at the top/rear of racks, with the ports facing the rear (hot aisle). Recommendations are based on a standard 29" EIA rail depth. For non-standard installations or switches not listed, please contact us.

Q Search Results: 1   ▼ Applied Filters: Manufacturer: Cisco ⊖   Model: 4948 ⊖

SwitchAir Model	Manufacturer	Model	Intake		
Search by Model Number	Cisco ▼	4948 ▼	- Any - ▼	SEARCH	RESET ALL

| Manufacturer ▲	Model	RU	Depth	Intake	Exhaust	Passive fit	Active fit
Cisco	4948	1	16.14"	Dual Side	Rear	SA1-01001NB 🖼	SA2-002 🖼

Space-Neutral (Mostly)

All Geist SwitchAir models are classified by "U" height. But, in most cases, the SwitchAir is space-neutral within a cabinet. That is, it's not taking up any space that could otherwise be occupied by other hardware.

The exception to this rule is the SA2-006, though its purpose is to address larger, core switches like a Cisco 6504 (render to the right).

However, the SA2-006 has the unique virtue of being reversible. If users wanted to ensure that a side-breathing core switch was receiving adequate airflow, they could position this SwitchAir both above and below the switch. The standard deployment is depicted in the image below but could be augmented by another SA2-006, whose fans deliver airflow "up" in the direction of the switch inlet.

For more industry perspective, Dell has written a comprehensive whitepaper, aptly titled Don't Bake Your Network Switches[5]. The Geist solutions are referenced near the end of the paper as "Switch ductwork."
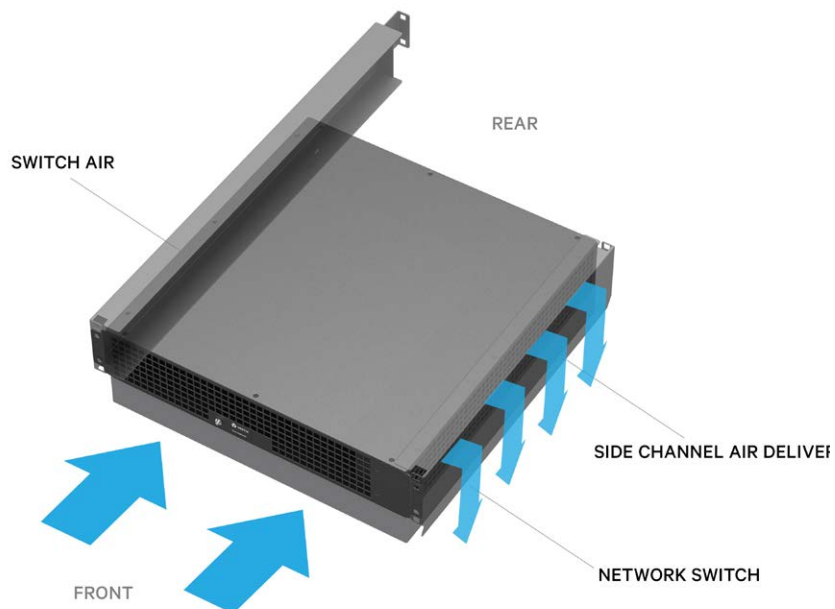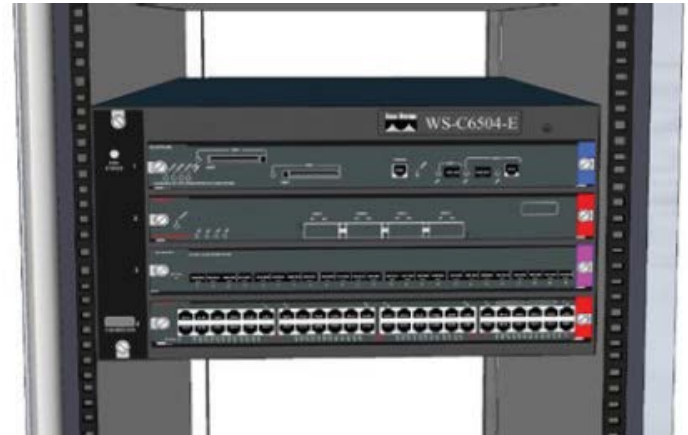
Sources:

[1] http://www.cisco.com/c/en/us/td/docs/switches/lan/catalyst4900/4948/4948_in/01intro.html

[2] http://www.cisco.com/c/en/us/td/docs/switches/lan/catalyst4900/4948E/installation/guide/4948E_ins/01over.html

[3] http://www.cisco.com/c/en/us/td/docs/switches/lan/catalyst4900/4948E/installation/guide/4948E_ins/01over.html

[4] http://i.dell.com/sites/doccontent/business/solutions/engineering-docs/en/Documents/dont-bake-network-switches.pdf

[5] http://www.dell.com/learn/us/en/04/business~solutions~engineering-docs~en/documents~dont-bake-network-switches.pdf

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SL-70497 (R02/19)