WhiteSpace CIS Field Guide

Solving the Big Problem in Your Network IT Closet

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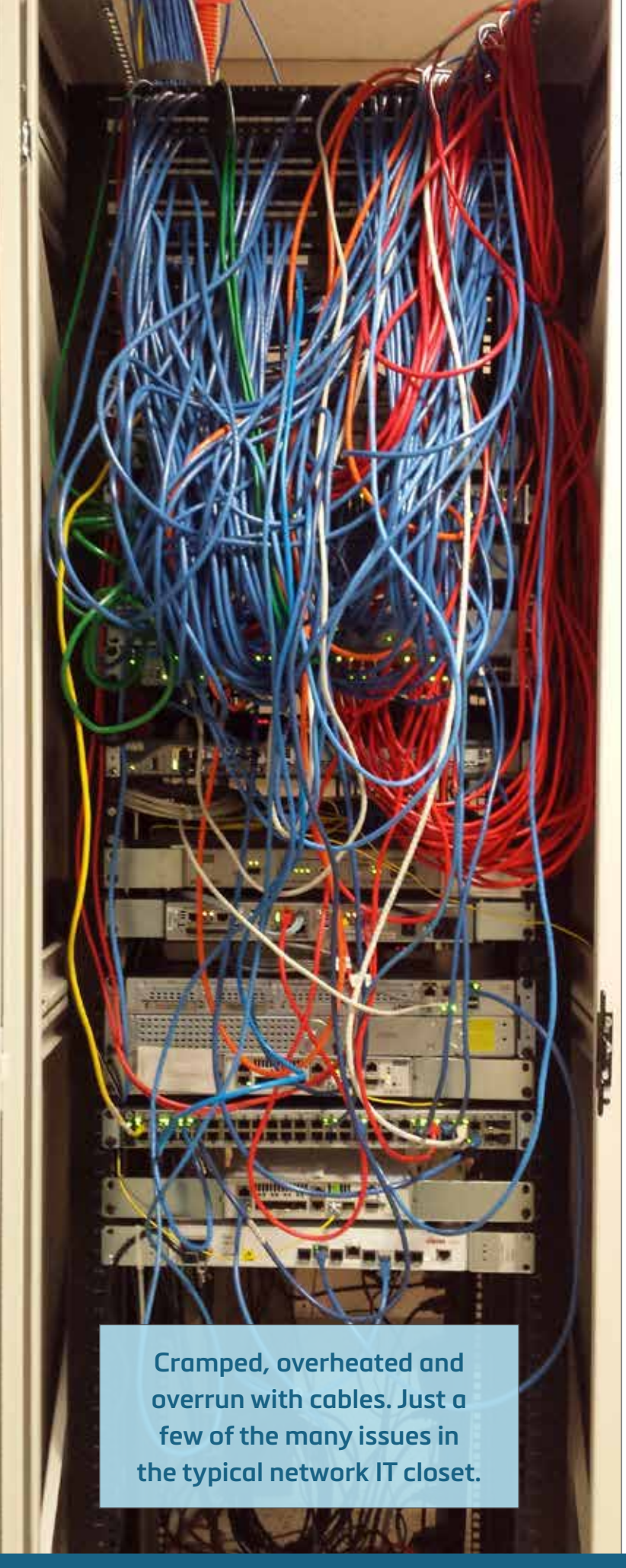


Cramped, overheated and overrun with cables. Just a few of the many issues in the typical network IT closet.

The Big Problem in the Network Closet

Traditional wiring closets were never designed to accommodate modern IT equipment. The spaces are cramped, poorly supplied with power, and lacking adequate airflow.

If you manage a network IT closet, you may already have encountered issues such as:

- lack of space
- poor airflow
- high temperatures
- difficulties mounting the equipment
- insufficient supply of power
- power distribution challenges.

And the situation is only about to get worse. Each year, the new batch of equipment runs hotter, draws more power, and requires additional considerations for mounting, cooling venting, powering and cabling.

Even if you only replace one or two pieces of equipment each year, you will eventually run into significant challenges.

This guide will help you avoid these problems and prepare your network closet for years of reliable, predictable operation. We will look at quick fixes you can make now, as well as a proven, step-by-step method to address issues relating to equipment-mounting, power, cabling, airflow and cooling.

The Time for Action is Now

Whether you are having issues today or not, there are many reasons why it make sense to address your network closet now. Here are the top three:

1. It is much easier to avoid IT issues than to diagnose and solve them after the fact.
2. Uptime, uptime, uptime. Downtime is an obvious risk if your equipment is overheating, but it can also occur because you do not have enough room for your equipment. For example, when upgrading, you might have to shut down your old gear before you can replace it with new gear.
3. You tend not to have as many people breathing down your neck when you are doing proactive work – a pretty important reason!

Start Here: The Quick Fixes

Later in this guide we share a proven, step-by-step method to avoid problems and prepare your network closet for years of productive use.

However, you may have some immediate problems to address first.

The following quick fixes will help you address the most common issues we see in network closets. Once these are done you will be able to focus on long-term problem avoidance and capacity planning.

1. Mount all equipment.

In our tours of countless network closets, we have seen it all: equipment resting precariously on chairs, sitting on other equipment or simply left on the floor. To give yourself room to work and help you diagnose issues, mount as much of the equipment as possible into your rack or enclosure. This is the safest option for staff members and for the equipment itself. If your rack is not suitable or large enough to mount the equipment, the next section of this guide will help you choose the right solution.

2. Clean up your cabling.

Poor cable management is one of the most common causes of downtime, so it is very important to address any potential cabling issues. Later in this guide we share a number of cable management best practices. For now, make sure that:

- unsupported cables aren't placing strain on your ports, especially if you are using fiber optic cabling
- none of your cables have any sharp bends
- cables are bundled with ties and not blocking your equipment exhaust.

3. Secure your power connections.

Make sure all equipment is securely plugged in and that your power distribution units (a.k.a. PDUs, power bars) are correctly rated for the power load and equipment used.

4. Check for obvious airflow or heat issues.

To ensure that you have a steady supply of cool air, remove boxes or other office equipment that may be blocking the flow of air into the closet. Make sure the equipment is mounted so that cool air can flow into it, and that the hotter exhaust air has a clear passage to rise up to the ceiling. Also, make sure that all equipment is exhausting out the back of your rack - and not into other equipment!

Step-by-Step Guide to Solving Problems in Your Network Closet

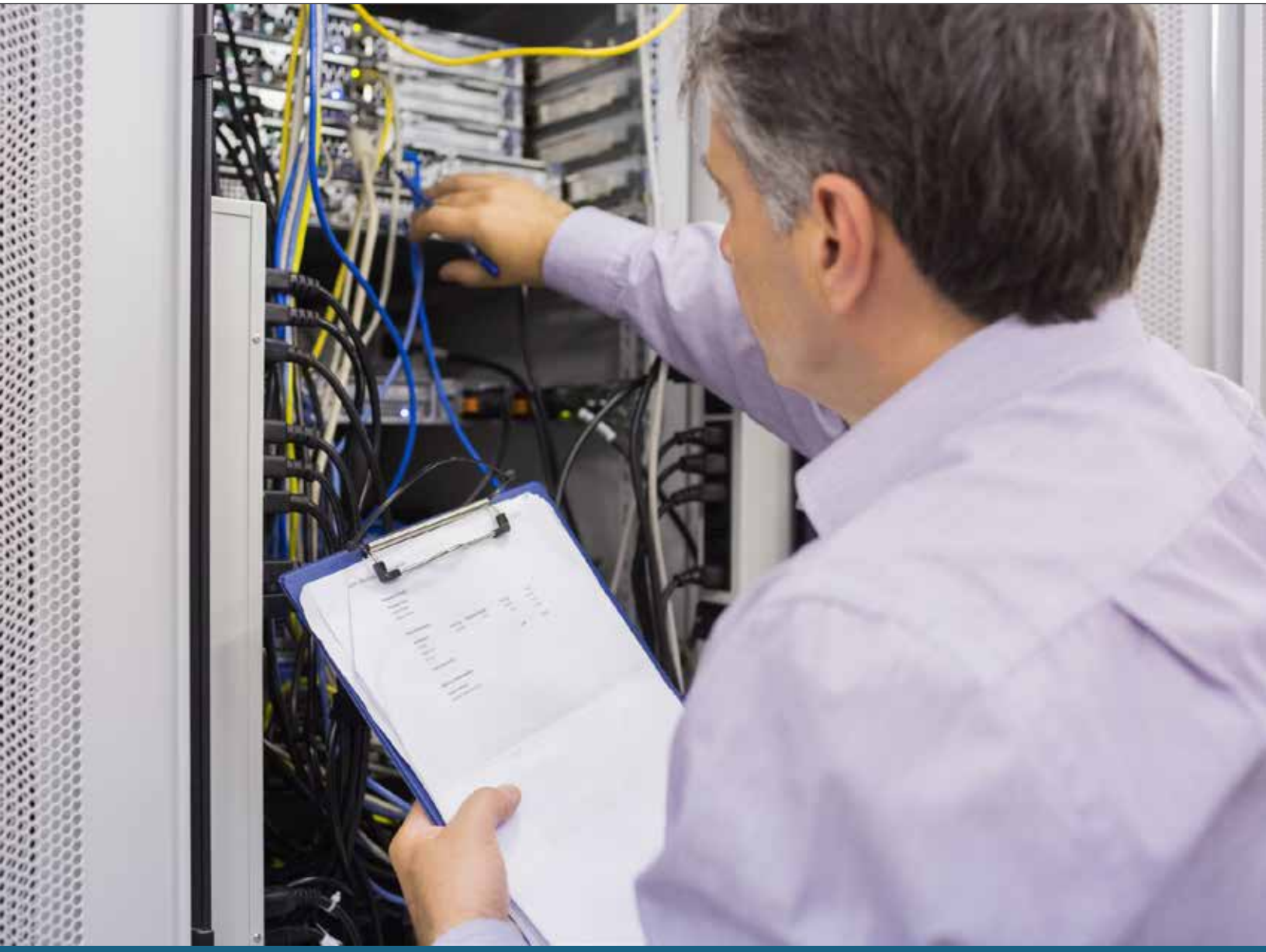
The modern network closet has basically become a mini data centre, so it is essential to manage it like a data centre.

The following step-by-step methodology is adapted from best practices that we use in large data centres and colocation facilities.

These steps are road-tested and proven to avoid heat issues, maximize capacity and ensure adequate power and cooling for years to come.

You can use these steps:

- to solve problems not addressed by our quick fixes
- to upgrade your existing network closet and make it ready for the future
- to help you design a network closet from scratch
- as an ongoing management checklist for your network closet.



Step 1 – Forecast your equipment needs

Whether you are planning a large data centre or a small network closet, your infrastructure decisions will always be driven by the needs of the equipment. As you prepare your network closet for the future, it is therefore important to have a good idea of your equipment needs over the coming years.

This means finding out as much as you can about the quantity and type of equipment you will be adding to the network closet. Be thorough with your research because you will have to make critical decisions about power, mounting and airflow management based on very detailed equipment specifications.

For example, if you expect to upgrade your network switch in the coming years, you may be required to accommodate a switch that is several u-spaces taller than your existing switch. Or it may have an unusual airflow pattern or a non-standard power connection. Knowing these details in advance will allow you to leave adequate space in your rack and to plan your power and airflow management requirements accordingly.

Ready, aim, measure.

An infrared thermometer: great for doing spot temperature checks.

A hand-held, infrared thermometer is a great tool to spot potential heat or airflow issues in the network closet. Initially, you want to ensure that equipment intake temperatures are within ASHRAE's recommended range of 18˚C to 27˚C[1]. To take an accurate reading, point the infrared beam at the metal grill near the intake fan. If you can't find the intake fan, you can hold up a piece of paper and run it along the side or bottom of the equipment. When the paper gets sucked in, you know you have found the fan. If your intake temperatures are consistently near or above the upper limit recommended by ASHRAE, you could seriously shorten the lifespan of your equipment and risk shutdowns. In Step 7 of this guide, we share several approaches to lower your intake temperatures and meet ASHRAE guidelines.

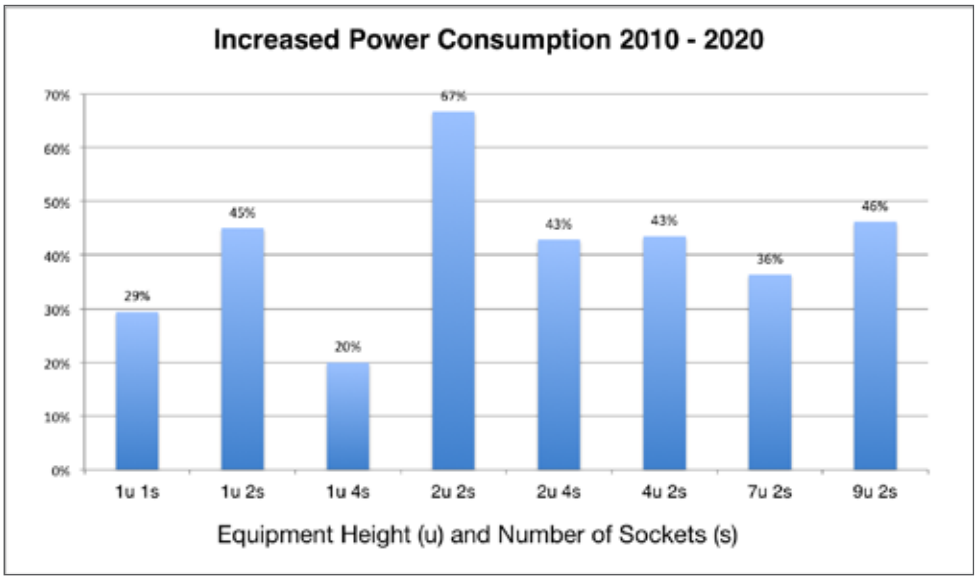
Step 2 – Provision an adequate and safe power supply to the closet

Here we are taking about the supply of power to the wall outlets, ensuring that there is enough of it, and that all components in the power infrastructure are rated correctly for the loads involved.

The most important thing to say about this step is that unless you are a licensed electrician, you are going to need help. If you don't have a certified electrical worker on staff, you will need to bring in an expert that is proficient in data centre power.

As you plan your power needs, something to keep in mind is that your network closet is going to require a greater supply of power over time. This is an obvious conclusion if you are planning to add more equipment, but it is also true even if you only replace existing equipment as it reaches the end of its lifespan.

Why? Equipment trends show that new equipment is getting hotter and more power hungry over time. An ASHRAE study predicted that average power draws in fully loaded equipment racks would increase by 20 to 67 percent in the period from 2010 to 2020[2].



Data: Beaty Finch February 2015

So, to estimate your power requirements, you will need to take into account:

- power requirements of equipment that will need to be replaced (to be safe, you may want to assume that replacements will draw twice as much power as the equipment they are replacing)
- power requirements of all net new equipment you plan to add over the next five to ten years.

With these numbers in hand you can work with your electrician and facilities manager to ensure that the network closet is outfitted with a safe, sufficient supply of power from the breaker. To do that you will often need to run several power feeds to the network closet.

[2] *http://bit.ly/WSCIS_ASHRAE*

Step 3 – Plan your power distribution

Once you have ensured that you will have the right power to the room, the next step is to ensure that you can get it from the wall to the equipment.

Again, you will have to factor in your expected equipment needs. Many pieces of modern equipment have non-standard receptacles that require special cabling or power distribution units in order to connect them to a power supply.

Once you have a good handle on your equipment needs, you can then plan:

- the type of wall outlets required
- the location of wall outlets
- the quantity and type of PDUs required.

As you shop for PDUs, keep in mind that they can do much more than simply supply power. Newer models can also facilitate temperature and power monitoring. More on this in Step 8.

Unplanned power distribution can get messy quickly.

A vertical, rack-mounted PDU helps keep things tidy and distribute power to the entire cabinet.

Step 4 – Get the right rack

The equipment rack (enclosure) is a core component of your network closet infrastructure. Your choice of rack will determine your ability to:

- accommodate new equipment
- supply adequate power
- manage airflow to and from the equipment
- manage airflow around the rack and out of the closet.

Unfortunately, the days of deploying a basic two-post rack in the network closet are over. To accommodate modern equipment and prepare yourself for the future, you should really be looking at a data-centre grade enclosure platform.

Here are some things to consider when choosing an enclosure that will serve as a long-term platform for your network closet:

- Go deep: modern equipment requires at least a 36" deep rack.
- Leave yourself the option of a door. At some point you may need to enclose the equipment for airflow or security reasons. Be sure to get a rack that not only accommodates your deepest equipment, but also leaves room to install (and close) a door.
- Ensure that the rack facilitates cable management by providing cable channels and accessories such as strain relief bars.
- Make sure the rack accommodates airflow management techniques such as blanking panels and overhead heat containment chimneys.

Deeper racks give you the option of adding doors, which provide greater airflow and security management options.

Built-in management troughs keep cable tidy and secure.

Metal bars and frame openings provide support for bundles of cable.

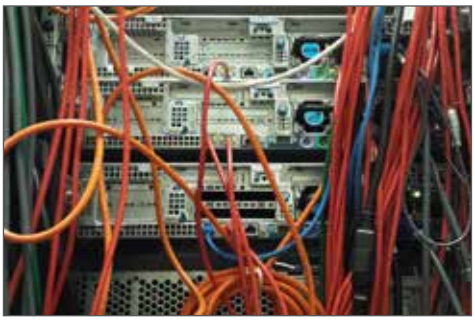
Step 5 – Manage cables properly to ensure connectivity

For many IT professionals and telecommunications installers, neat and tidy cabling may be a matter of professional pride, but that is not the only reason to deal with cables the right way.

Messy and unorganized cabling can cause a host of serious issues including loss of connectivity, equipment overheating and even worker injury.

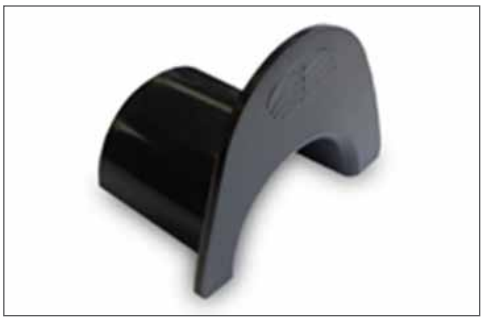
Whether you are planning a new network closet or fixing up your existing location, here are the key best practices to follow:

- All electrical cabling should be professionally installed and safeguarded with conduits if it is not behind the wall.
- All cabling coming into the closet should be bundled and supported by cabling troughs or other solutions that relieve cable strain.
- Use color coding and tags wherever possible to allow workers to clearly identify the source and destination of all cabling.
- For both network and power cables, use the smallest length of cabling possible for the particular application.
- Take advantage of your rack's built-in cable management features to support cabling running into and out of your equipment. Where needed, use cable management accessories such as strain relief bars.
- Ensure that none of the cabling has sharp bends. This is especially important for fiber optic cable, which is more sensitive to stretching, bending and crushing than traditional copper cable[3]. You can use spools to guide the cable and avoid excessive bending.
- To avoid impeding the flow of air, be sure to secure all cabling away from equipment air inlets and exhausts.



Unsupported, unbundled cable puts stress on connectors, which is the major cause of lost connectivity.

Well-organized cable, supported by built-in strain relief bars.



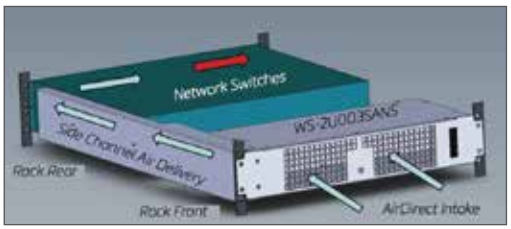
A simple cable spool mounted to the rack prevents sharp bends in fiber optic cable.

[3]Cisco offers an excellent resource on cable installation and management: http://bit.ly/WSCIS_Cisco

Step 6 – Optimize airflow in and around the rack

Unmanaged cable blocks equipment exhaust, leading to hotspots and equipment shutdowns.

Use blanking panels to cover open u-spaces. This prevents hot air from recirculating back into the equipment inlets.



An active airflow manager, directing cool air to a side-intake switch.

Now that you have put in place the right rack and implemented cable management best practices, you are on your way to avoiding many of the common problems related to heat, power and space in the network closet.

The next step is to have a close look at airflow in and around the rack. The goal is to ensure that cool air can reach the equipment inlets, and that hot exhaust air doesn't recirculate back into the equipment.

Failure to do so can cause hotspots and overheated equipment that leads to shutdowns and premature equipment failure. The following steps will help ensure that those things don't happen:

- To avoid cool air bypassing the equipment inlets, install blanking panels in all open u-spaces in the front of the rack.
- Cool air can also bypass equipment by flowing underneath the rack. If you detect that this is happening, you can use plastic sheeting or data centre foam to seal the space underneath the rack.
- Check the back of the rack for airflow obstructions. These can cause hotspots and lead to equipment shutdowns.
- Cabling is a common cause of airflow obstructions. Any cabling that is blocking the exhaust should be bundled and moved out of the way with ties or strain relief bars. To cut down on cable volumes, replace all cables with the shortest lengths possible.
- Exhaust air should be allowed to flow unimpeded from the back of the rack. If your rear door is solid or has too few perforations it could be causing a build-up of hot air. High-flow perforated doors are an easy fix.
- Hot exhaust air doesn't always flow away from the back of the rack, leading to possible recirculation back into the equipment inlets. To avoid this, you can "guide" the hot air away from the rack. Rack chimneys offer a great way to do that, channeling hot exhaust air directly away from the rack into the ceiling plenum.
- Sometimes the equipment itself can cause airflow and heat issues within the rack. For example, some of the newer switches have a side-to-side airflow configuration, rather than the usual front-to-back setup. This could lead to the switch being starved of cool air. In these cases, you can install active or passive airflow directors that mount within the rack and supply cool air directly to the equipment that needs it.

Step 7 – Manage airflow and temperatures within the closet

Ceiling tiles can be removed to allow hot air to rise higher, bringing cooler temperatures to equipment outlets.

A typical air extraction fan, great for pushing hot air out of the ceiling and pulling in cooler air.

A ceiling-mounted air extraction fan.

Once your rack is in good shape, it is time for a macro look at airflow and temperatures in the network closet as a whole.

If you find that the entire closet is too hot, there are a number of simple steps you can take to address that. These steps are listed in the order we would usually recommend looking at them. As the list progresses, the costs and complexity also rise.

1. Let the hot air rise higher.

If you have a ceiling plenum, one simple, "passive" way to lower the ambient room temperature is to allow hot air to rise more easily into the plenum. To do this, you can:

- add perforated ceiling tiles
- ensure that the perforated ceiling tiles are above the equipment rack
- increase the number of perforated ceiling tiles
- remove the ceiling tiles entirely

These steps allow the band of hot air to rise higher, which lowers the temperature at the level of the equipment inlets.

2. Make it easier for cool air to enter the closet.

To enhance the passive airflow approach above, you can install wall- or door-mounted vents to allow more cool air to enter the closet.

3. Push out the hot air, pull in more cool air.

When passive solutions are not enough, you can employ an active airflow solution. One common solution involves the use of powered fans mounted in the ceiling or near the top of a wall. The fans push hot air into the ceiling plenum, or into a hallway, which helps draw in more cool air from under the door or from a vent. Some organizations will install a dual-fan system, pulling in cool air from the hallway as well as pushing the hot air into the plenum.

4. Separate the hot and cool air entirely.

If these solutions aren't enough, you may need to look at a containment solution that compartmentalizes the air within the closet. This involves creating a divider between the front and back of the rack, essentially cutting the room in two. The divider can be created from materials such as extruded aluminum and lexan plastic, forming an inexpensive but highly effective barrier between the hot and cool air.

5. Active cooling.

It is very rare that you would ever need to do it, but as a last resort, you could consider adding an A/C unit. However, adding A/C doesn't immediately solve your temperature issues – you still need to manage airflow, as outlined above and in Step 6. Another caution about A/C is that it introduces a number of additional issues that you need to address. These include: maintenance, operating costs, additional power requirements, questions about where to locate the unit, where to exhaust the hot air and how to deal with condensation. Given these considerations, we always recommend first exploring passive options, which are less complex and have a lower lifetime cost.

Step 8 – Monitor conditions within the closet

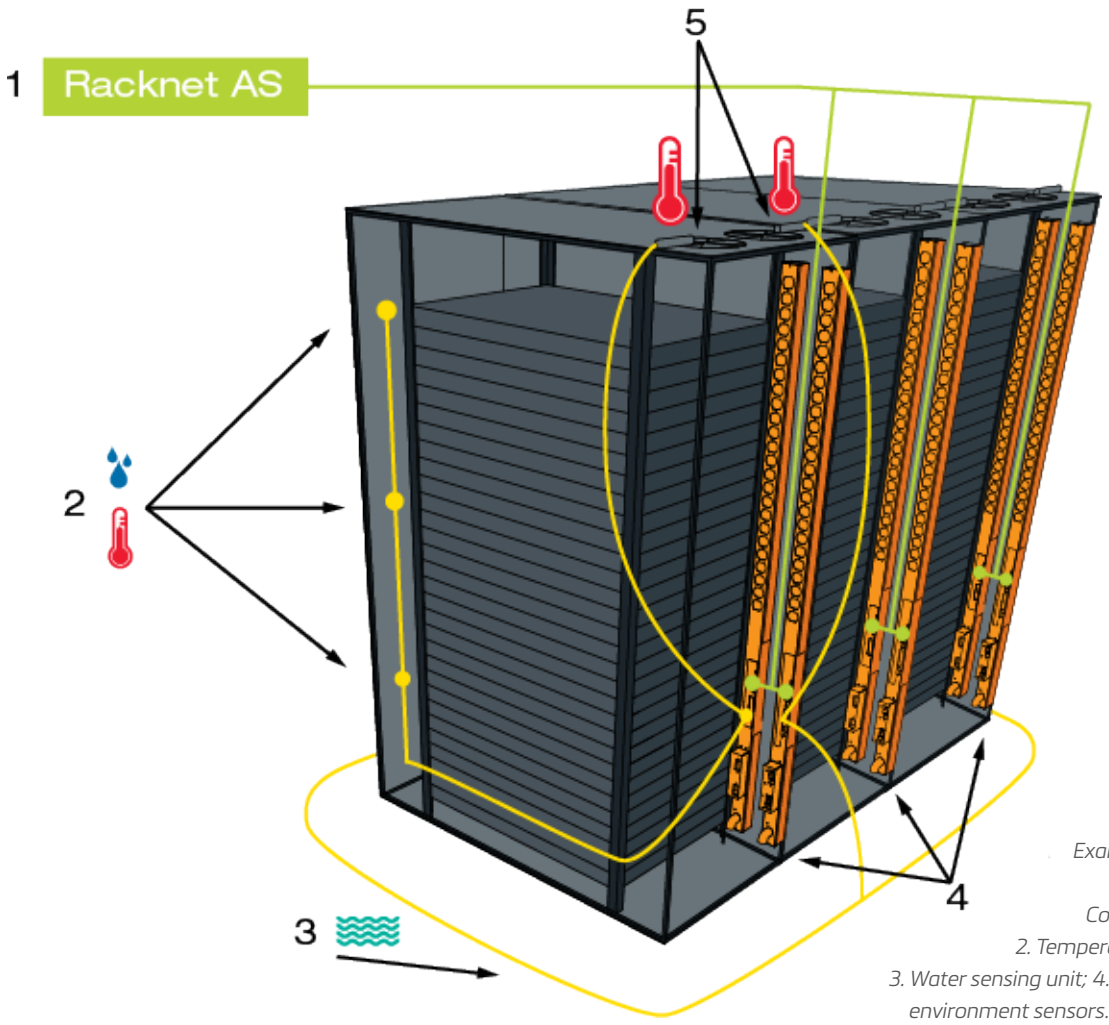
Network closets are dynamic environments, so even if you set things up perfectly, you can't close the door and forget about it. To help maintain optimal conditions within your network closet it helps to employ remote monitoring tools.

There are a number of different remote monitoring tools, each offering different benefits. The common benefit is that they are networked, which means you can keep an eye on things remotely and receive alerts of potential problems.

Here are a few common examples used in network closets:

- Room-level temperature sensors provide an inexpensive way to keep an eye on ambient temperatures in the closet. If the overall room temperature rises, it could mean that something has failed, or that there is an obstruction to the air flowing into or out of the closet.
- In-rack temperature sensors can be connected to your PDU units, allowing you to get a closer look at temperatures at different parts of the rack. This can alert you to equipment failure or a problem with airflow around the rack.
- Some active airflow management devices, such as ceiling-mounted extractor fans, can also be networked so that you can receive an alert if the fans stop running.

If you manage multiple network closets, monitoring tools like these are worth their weight in gold, saving you time and keeping your attention focused where it is needed most.



Example setup of condition monitoring sensors and monitoring software. Components: 1. Monitoring software; 2. Temperature/Humidity/Dewpoint Sensors; 3. Water sensing unit; 4.Intelligent PDUs sending data from environment sensors. 5. Temperature and airflow sensors. Source: geistglobalcom.

Avoid issues, avoid headaches

One way or another, network closets are set to demand more of your time and resources over the coming decade.

Rather than continually putting band-aids on the problem, implementing the steps in this guide will keep you focused on problem avoidance and long-term capacity planning.

As a result, you'll experience less downtime, less worry and get more sleep!

What next?

For help implementing these steps, get in touch with your local WhiteSpace CIS specialist.

We provide a wide range of solutions for the network closet, including:

- assessment, planning and design
- network closet enclosures
- airflow management
- power distribution
- containment.

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Contact WhiteSpace for more information

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