CABLELINK
SOLUTIONS

Arlington High School

Network Closet Retrofit

Fall 2021

By Jason DuBose

Sometimes you are not able to do a complete Network Cabling overhaul. In that case you do a Telecommunications Closet retrofit. Something that we at Cablelink Solutions-Texas pride ourselves in completing on time , on budget and with a clean fresh look.

Lee Solis, Owner of Cablelink Solutions-Texas met with Arlington ISD Network Services early in the Fall of 2021. Arlington ISD Network Services likes to select one of the six traditional high Schools to perform retrofit work especially for the main I.T. Closets. Usually during the Winter Break during the Holidays , basically 2 weeks of a totally empty school, no students, and no teachers. For the Fall of 2021, the Winter Break the selected project would be Arlington High School. We would be able to start on December 17th, 2021 and would need to have our work completed before the students returned on January 5, 2022. We would be doing retrofit work in seven of the schools Telecom Closets for this first phase of the project. MDF/MER, IDF (A, B, C, D, E & G).

Arlington High School is the oldest High School in the District. The original location was built in 1922. The current location was built about one mile South of the original location and opened in the Fall of 1956. It averages a student body of approximately 2800 students and a faculty/staff of around 250 people.

As usual per the District Network cabling Standard, they would want the following products used for these parts of the retrofit.

- Legrand-Ortronics Clarity Cat 6 48-port preloaded patch panels.
- Panduit Vertical and Horizontal Wire managers
- Chatsworth Racks, Ladder rack and rack connecting hardware.
- Berk-tek is the UTP cable the district uses, I mention this because even though for this part we would not be pulling any new cables, we would be reterminating this brand of cable. *Note: The district has used the Ortronics/Berk-Tek combination for almost 20 years and doesn't plan to change; even though they know that the two companies are no longer solution partners. It is what THEY prefer.*

The overall objective was to create new rack space for future growth and also the upcoming addition of new CAT 6 camera drops spread out across the campus without need to add any additional racks. Space in the building was already at a premium. The current telecommunications closet locations already had to share space with air handler equipment or Custodial storage. So, the main focus was to go upward and reclaim rack space with newer high-density panels. Using Chatsworth 8ft-19 in. Racks to replace the existing 7ft-19 in. racks and also swapping out some of the older oversized 3 RU 48 Port and 5 RU 96 Port Ortronics CAT 5 and 5e Panels with newer Ortronics Preloaded Clarity 2 RU CAT 6 48-port patch panels. Also, in most cases we also swapped out the existing Panduit front/back 4" vertical managers with the Panduit Front/Back for the deeper 6" vertical cable managers to better dress the patch cords in the front and route the incoming station cables coming to the rack from the patch panels.

Being an Ortronics CIP (Certified Installation Partner) Cablelink Solutions-Texas loves working with the Ortronics Clarity line of products, especially the Clarity preloaded 48 port Cat 6 patch panels. Its high-quality construction and ease of termination make it a key component in being able to complete a project of this magnitude in the window of time we had.

When undertaking a complex network structured cabling task such as this, proper pre-planning is everything. One of the main tools Cablelink Solutions-Texas uses are detailed Visio drawings of the existing rack layout and the preposed new rack layout with accompanying notes.

As you can see on the Visio drawing below, Cablelink Solutions can also provide you with detailed rack elevations. These give our Installers an exact layout of how the new rack, cable managers and patch panels should be oriented. No hand drawn rack layouts that can be misinterpreted. A detailed color Visio drawing with specific notes to make sure work is completed correctly.

In the below drawing the one on the left has been created as part of our discovery process of what is existing currently. This one is showing the layout with a traditional 7ft 19" Rack. 4"x4" front and back vertical managers, primarily 1 RU Horizontal wire managers. The drawing on the right shows what it would look like with an 8ft 19" Rack 6" x6" front and back Vertical wire managers and also new Ortronics Cat 6 48 port Patch panels and 2RU Horizontal Wire managers.
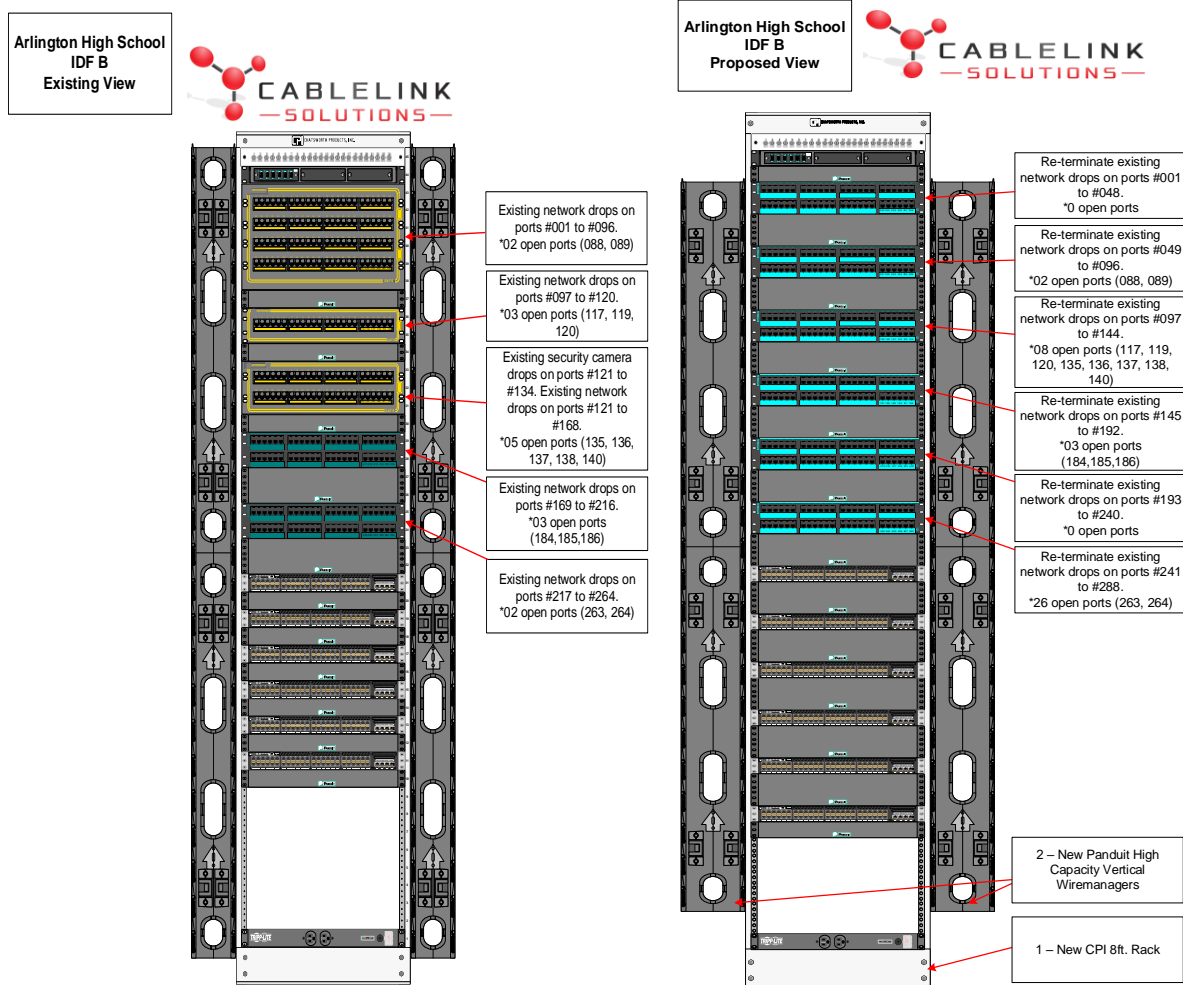
So, once we have this basic blueprint of what the rack will end up looking like then we also figure in any other additions that need to be made where we are tearing down and rebuilding the telecommunications closet racks. These additional items usually include additional ladder rack to support the cable up and down the walls or properly grounding the racks.

Some of the racks that we were retrofitting were over 25 years old. That was at a time when a standard practice was to ground to a copper or cold-water pipe. Which now in 2022 is not recommended by the N.E.C. because of the use of Plastic pipe in plumbing. Also "building steel" might not always serve as a good ground point either. In several of the rooms we reworked we realized that the grounding needed to be updated, even if it meant running a completely new #6 Awg ground wire to a proper recognized ground point.

Over the years different types of cable, colors, and brands of UTP cable had been terminated on the panel. While we are reworking the racks, we are also taking these several generations of cabling and redressing them to make them look more consistent and uniform. Some of the older Cat 5 cable had a manufacture date of 08/24/1994 stamped on them. Something else to consider is the actual patch panel termination. Years ago, the tolerances for the amount of the cable jacket that was stripped back and the about of untwist allowed for the individual cable pairs was less critical. So, technicians sometimes stripped back way too much jacket and untwist. We reterminated the cables with the modern rules for length of jacket removal and amount of wire pair untwist accounted for.

Back in the 1990's and 2000's there were separate cables and colors to differentiate between telephone and data drops. The older telephone cabling being patched over to old style phone systems, before they had VOIP. Now as we know a UTP Data drop can be used for a PC, a projector, security camera, a wireless access point, or for a Voice over IP (VOIP) phone set. So, there might be some cable color mixing.

For Arlington ISD they started out with white Cat 5 being a Data drop when they first started running UTP cable back in the Mid 90's. Towards the end of the 1990's the district began implementing newer and revised cabling standards which made the primary data cable color green and the primary camera and Wap color being blue.

As you can see from the picture on the left much of the older white cabling is at the top of the rack where it was the original cabling installed.

Note: the plastic zip ties are only temporary and will be replaced with Velcro after the cables have been laced in and terminated. They help with breaking out the cables in pairs for the top and bottom port punch down position.

Once the layout is set and we have created a specific plan of attack for each closet we start the tear down at the appointed time when they students and staff are going to be out of the building for several days. Usually, we start this work for the district over a long holiday or over the summer break. If during the Summer Break that school is not assigned to host summer school classes.

Once we are allowed to start our Techs start by taking lots of pictures on their cell phones of the existing rack and connections. What is hooked into what port or what device it is currently connected

to. We make it a point to assign a team to a specific closet and not change them during the entire process of the rework. After taking pictures from all angles front and back, they carefully label each patch cord on the patch panel port it goes into and leave the patch cord plugged into the Network electronics devices as they remove it from the rack.

Then they go on the back side and they painstaking label each and every cable terminated onto the back of the patch panel. AISDs' labeling scheme is very easy to work with. They simply label it as the patch port panel number for that closet. So, 1-48 is one the first patch panel and 49-96 is patch panel 2

and so on. So, a typical AISD label might be "A-096" for telecommunication closet A patch panel port 96. It's the Closet number a dash and a 3-digit number with a zero-place holder for a missing number so the port 1 would be A-001. When cable is added it just goes to the next available port number. The drops for W.A.P.s and Security Cameras are usually put at the very end of the panels and grouped together.

Some would say the downside of this system is that a room could have a cable labeled A-023 next to a newer drop that is A-233. This is what works for the district and for us when working with this customer. We have always held the belief that the customer will ask our input for solutions if they are looking to solve a problem. We don't feel the need to prove to the customer our competency by suggesting changes that would only make their overall system more complicated. We have always felt the true proof of our competence and value, what really counts is performing quality work for our customers.

So, you have a better idea of how we at Cablelink Solutions-Texas go about the process of a task that can be extremely precise and challenging. Listed below is our base set of procedural steps we follow to perform this type of work. In many ways doing these types of Closet retrofit projects can be compared to performing open heart surgery to each one of these telecommunications closets. So, you need a solid plan if you want to produce positive results for the customer in the time frame required.

The Cablelink Solutions-Texas 13 step IT closet rework Process.

1. **DISCOVERY:** Meeting with the **Customer** to receive their input on what they are wanting to have at the end. Going out into the field with the customer and getting the details of each closet to be able to create an informed solution and plan for the customer.
   a. **# of drops per rack**
   b. **# of racks**
   c. **Types of wire managers**
   d. **Layout of panels and network electronics**
   e. **Ladder rack and other possible improvements such as better grounding.**

2. **CREATING A NEW CLOSET VISION AND THE QUOTE:** In this step we are putting all the information we gather on step one into a cohesive plan and creating a quotation for its cost.
   a. **Detailed Visio Drawing of the Rack elevations**
   b. **Getting current pricing from vendors**
   c. **Creating the detailed Scope of Work and Quote for the Customer to review**

3. **SUBMITTING THE INTIAL QUOTE TO THE CUSTOMER AND MAKE NECESSARY CHANGES:**
   a. **Go over the quote with the customer, get input on any adds or subtractions they would like to the quote. Adjust as needed.**

4. **CUSTOMER APPROVAL OF THE PRESENTED QUOTATION:** The quotation has been approved by the Customer and the start date has been finalized.
   a. *Preform telecommunications closet cable pretesting if requested as part of the quote*.
   b. **Start ordering and gathering required materials**
   c. **Cablelink Solutions-Texas upper management meets with Cablelink Solutions-Texas install team to go over the plan and assign tasks to team members.**

5. **PRE-TEARDOWN PROCESS:** This is when we start the telecommunications closet tear down process. We have been given the go ahead by the district IT department and also a high-ranking member of the staff, usually the school's Principal. We have met with this person ahead of time, so they know exactly what to tell the staff and teachers. This helps because it reduces the amount of trouble calls by teachers or staff that might try to come in during the break and work using the network. We start once the school has given us permission. Once this starts, we are committed to the rest of the process until we get it completed. Since we are not actually

disconnecting anything yet, and this is not yet a destructive process, we can do some of this ahead of time. It is put here for the sake of logical progression.

    a. **Label the patch cords with the patch panel port coming from the Network electronics on the patch panel side.**

    b. **Label Network electronics, especially the order of the network switches and which cables connect them in the back.**

    c. **Take pictures on cell phone of panel front, back and what network electronics are plugged into. Also, where fiber jumpers are connected to switches. All this can be referenced in the replacement phase.**

6. **BEGIN THE ACTUAL TEAR DOWN PROCESS:** At this stage the whole existing Rack and telecommunications closet setup is going to be completely torn down and start the rebuilding process.

    a. **Remove all horizontal cabling from back of patch panels.**
    b. **Removed now disconnected old patch panels.**
    c. **Unplug the Patch cords on the Patch panel side for the Network Electronics.**
    d. **Removed the Network Electronics from the Rack, set aside till later.**
    e. **Tear down old Ladder rack connected to Rack. (top plates and waterfall brackets)**
    f. **Tear down and unbolt from floor the old ladder rack.**

7. **START THE REBUILD PROCESS:**

    a. **Drill required additional core holes and install sleeves. Over the years cores and sleeves could have been overfilled for additional cables being added. In some cases, we add an additional 3" sleeve or core to the existing 2" to allow the proper cable fill ratio to be maintained again.**
    b. **Build new rack**
    c. **Install new patch panels**
    d. **Install new Horizontal cable managers between panels and where switches will be later. Referring back to the detailed Visio drawing of what the new rack layout is.**
    e. **Install new larger 6" x 6" Vertical front and back cable management.**
    f. **Bolt newly built out ladder rack to the floor. Having all the part attached first allows fine adjustments to its orientation with Vertical manager on. Also, the customer might want the rack mounting in a different location or at a different orientation that the previous rack.**
    g. **Install new ladder rack and secure rack via top plate to ladder rack. Also install ladder rack up and down walls to dress cables coming from the floor or ceiling where not in Vertical wire managers.**

8. REROUTE AND REDRESS CABLES TO BE TERMINATED INTO THE NEW RACK AND PATCH PANELS:
   a. Reroute cables back to a point where additional needed slack can be gained and former bad cabling pathway practices can be corrected. Also remove, when possible, where cables are crossing each other in ways that could hinder proper redressing.
   b. Break out and sort all cables into groups of 12 or 24 in sequential order to best lace into the new rack and terminate on the new patch panels.

9. RETERMINATE ALL THE CABLES INTO THEIR NEW PATCH PANELS ON THE RACK.

10. LABEL THE FRONT OF THE NEWLY INSTALLED PATCH PANELS WITH THE CORRECT CIRCUIT ID'S.
    a. *Post-Test all cables if this is an option that customer has requested as part of the project. Correct any issues.*

11. REINSTALL NETWORK EQUIPMENT BACK INTO RACKS AND REPATCH ALL CABLES TO PROPER PATCH PANEL PORTS.
    a. Do a gentle wipe down of the surfaces of the Network equipment to remove accumulated dust from equipment before putting it back in the rack. Vacuum fan vent ports when practical to remove accumulated dust.
    b. Connect the rear switch connect cables to the network switches.
    c. Turn equipment back on and allow it to comeback up. To make sure all the equipment is working properly.

12. CLEAN UP TELECOMMUNICATION CLOSET ROOMS, REMOVE OLD RACKS AND OTHER PARTS AS WELL AS PACKAGING FROM NEWLY ADDED RACK AND HARDWARE.
    a. We promote doing most of this as the project progresses to maintain a clean work area. Still, there might be some left over parts from the old setup that need to be taken to the dumpster or back to the customer.
    b. Sweep/Vacuum the floors, to remove any debris caused by the rebuild work or by installing new core holes.
    c. Wiping down the front and back of the racks. After the dust has settled. The racks can have a static charge especially the plastic wire manager covers that can attract dust. We wipe it down with an antistatic gentle cleaning product to give the racks that finished look.

13. CONTACT THE CUSTOMERS I.T. SUPPORT STAFF AND HAVE THEM CHECK THAT THEY ARE SEEING ALL THE NETWORK ELECTRONICS AND THAT THE SWITCHES ARE IN THE CORRECT ORDER IN THE STACK.
    a. They can also check and make sure that all the wireless access points are back up.
    b. If the Security Cameras are managed by a different group, then you need to also contact them and make sure that all the IP based security cameras have come back up.

Breakdown of work performed in the selected Telecommunications Closets.

MDF/MER:

This room had the most work performed in it by far. It was the only room of the seven that needed to have two racks replaced. It also needed some work done to help fix the damaged ceiling grid where over time cabling just sort of came out of the large opening with out any consideration to putting back the drop ceiling tiles. Leaving the room to look like the entire ceiling was about to fall on top of all the racks and equipment.
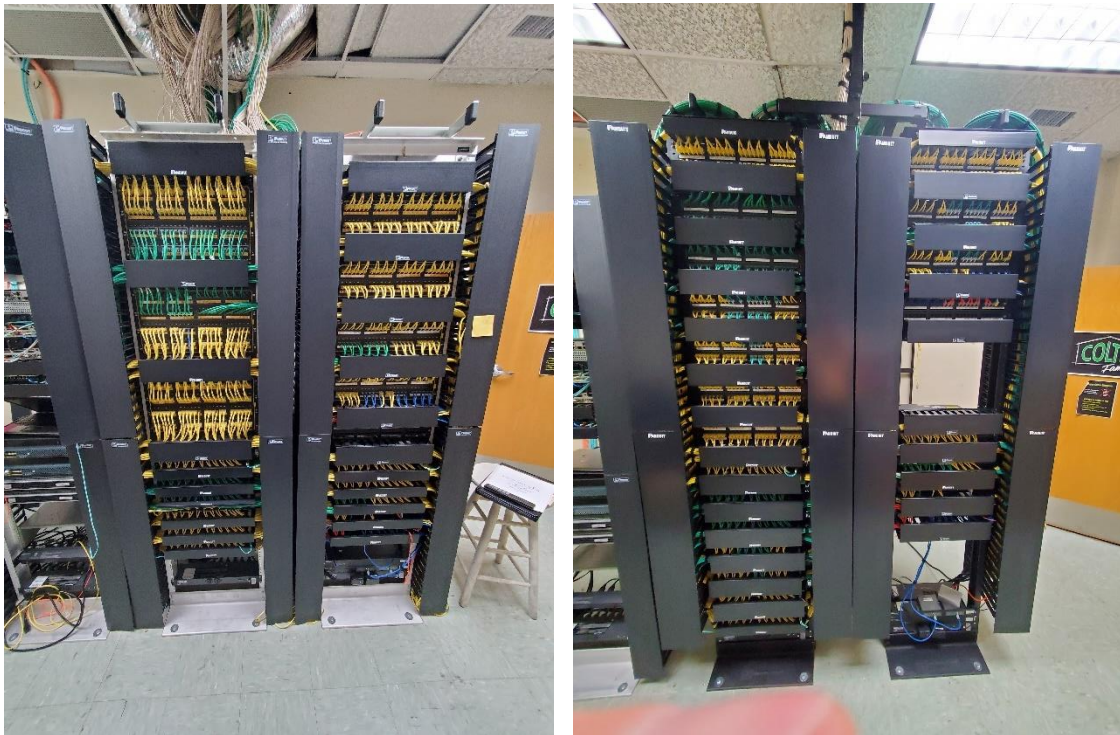

The picture on the left is the MDF before we started. Many of the white cables shown coming out of the ceiling were cut off in the past and were just hanging because they were once part of an old-style phone system. We were able to reroute them and also re-terminate them on the new panels, so they were available to be used again. Being cut short we used a vertical piece of ladder rack to still have some of the shorter white cables be able to dress down into the rack. We were also able to fix the damaged ceiling grid since we rerouted all the different cables that were before too short or crossing each other.

The overall goal in this room was to clean up the entire cabling layout and also gain some more space for future growth. Plus, with the new clean, well maintained cabling terminations it allows AISD

Technology staff easier access behind the racks. Lessening the risk of them getting snagged on loose cabling while trying to replace a switch or router.
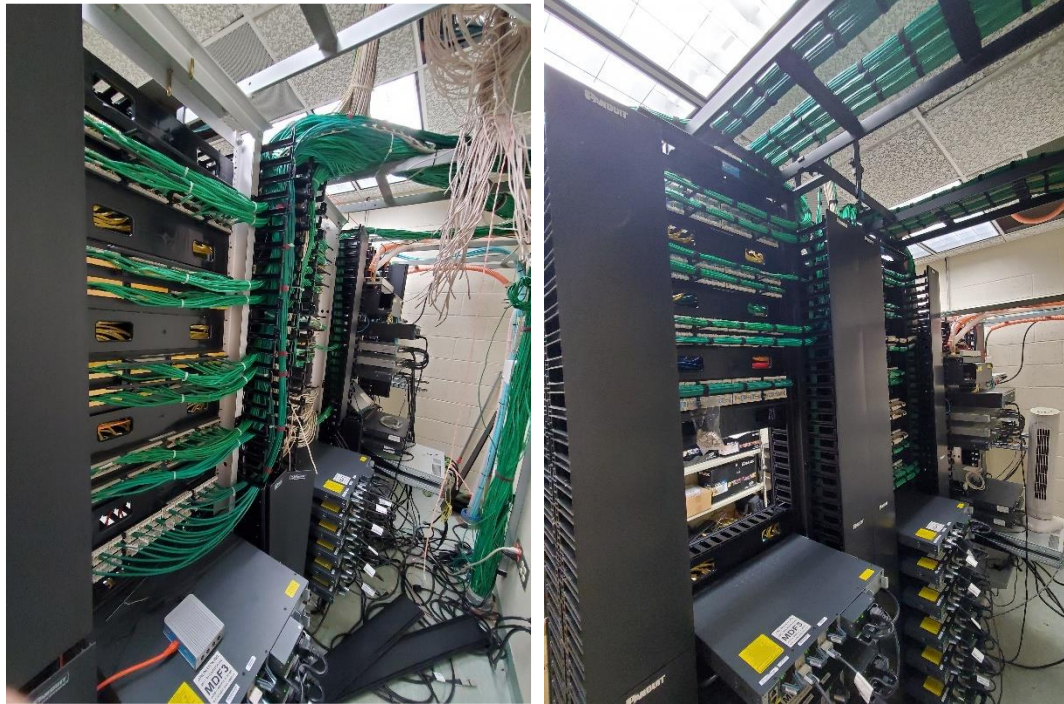
You can see the before and after pictures of the back side of the two replaced MDF racks in the above photos. A cleaner and more professional looking rack layout. Older cables that were no longer needed were removed; older white cables that were still in use got re-terminated on the new racks. Using the taller 8ft racks some of the cabling that was originally in the left rack was able to move over to the rack on the right side. Freeing up space in the left rack for future growth.

IDF A

This was probably the tiniest closet we dealt with on the project. This room was the schools original Building entrance point and DEMARC for the old telephone cabling from AT&T (Southwestern Bell). It was also where the OSP fiber enters the building from AT&T. They have a 7 ft enclosed metal equipment cabinet that takes up probably about 25% of the rooms usable space. Even though it's filled with mostly obsolete, unused equipment we decided to work around it. Originally, there was an old 3 ½ foot Swing gate style wall mount rack in there. We replaced it with a new 8ft 2-post 19" Chatsworth rack and used 4" front and back vertical managers due to the tight space. We also had to terminate (9) extremely short older cables on a wall mount patch panel bracket. We were not able to regain any more slack from the old cables. They were installed way back in the mid 1990's and the installers ran them without any slack loop at the Closet side. Also, some of them were ran at a diagonal instead of the current practice of running cable with 90-degree angles in J-hooks. These cables were so old they were running through bridle rings. So, because they could still be in use, we re-terminated these on a wall mounted patch panel. On this round we were just redoing the closet side. The information was given to the district and at a later time they will have us replace the cables still in use with new Cat 6 drops.

Once again there are several different colors and generations of cabling being re-terminated into the CAT 6 new patch panels. The new rack also allows the district to stake claim to parts of the closet for the future. In case some of the old Demarc telecom equipment is removed, it will not become a custodial storage closet. Note Blue AT&T(Southwestern Bell) cabinet in background.

IDF B

For this closet we needed to change the orientation of the rack and also drill new core holes so that the cable would feed into the bottom of the 6" x 6" front and back vertical managers. We also had to work around a natural gas pipe that came between floors that supplied the heating equipment on the 1st floor mechanical room. Needless to say, that was an immovable fixture that we had to work around.
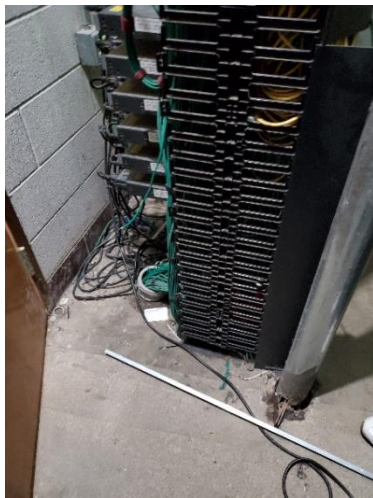
This is the original orientation of the rack in IDF B. As you can see the Cisco switches are almost impossible to access from the back side and in both pictures, you can see the gas pipe in the way covered by its protective casing. Also notice where the wooden door comes close to the rack.

We replaced the existing 7ft 2-post rack with an 8ft 2-post and new 2RU Horizontal wire managers and 6" x 6" vertical managers. Redressed and re-terminated the cabling onto new Cat 6 2RU 48 port patch panels. We had to drill new core holes on the left and right side where the vertical cable managers cover the floor. The natural gas pipe is less in the way than before. The wooden door will have its hinges reversed and it will eventually open outward instead of inward. This delayed us from mounting the left side's 6"x6" cable manager until the door can be rehung. At least now there is a full 1-1/2' of clearance from the back of the Cisco switch to the wall. So that the AISD Cisco Team can have easy access to the back of the switches.

In this closet several 3- and 4-foot yellow patch cords were used. So, when we relocated the patch panels and replaced the 1RU wire management with 2RU managers we needed to change out the short patch cords on the front with longer 7ft green patch cords. Here we used the Ortronics EZ patch Box. Each box contains 50 patch cords on a reel. You simply pull out a patch cord and it's connected to the next one by a disposable clip. You use what you need without having to open plastic bags or undoing twist ties. Very convenient and produces a lot less waste packaging to have to clean up.
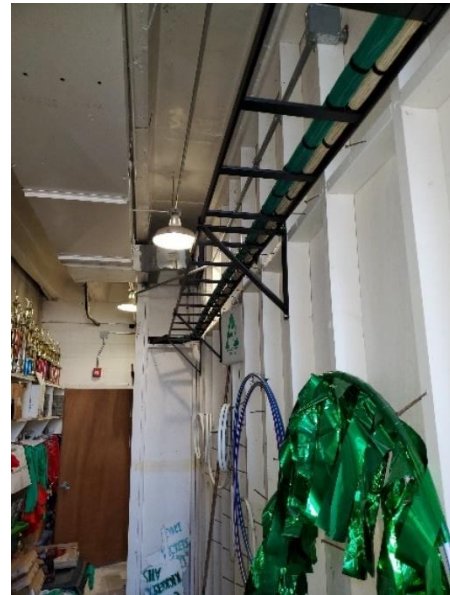
![CABLELINK SOLUTIONS]

IDF C

This was another closet that was placed in an Air handler room. We needed to install a new 8ft 2-post 19" rack and new wire management.

We needed to drill an additional floor core and add 2 new 2" wall sleeves. First, we needed to reduce the cable fill ratio in the existing 1 1/2" conduit. We replaced this with a new 2" sleeve then we rerouted the cables that came from the west section of the IDF to get back some slack we needed to re-terminate the cabling onto the new rack. The original installers went down the original 1 1/2'" above ceiling sleeve combining them, well past the direct path they could have taken on the 1st floor into the room below the IDF. Instead of adding a 2nd sleeve. By rerouting these cables, we regained about 20 ft of extra slack for every cable coming from the west side of the section covered by this IDF. By adding an extra 2" sleeve we also solved the overfilled conduit and created a new more direct path getting both runs to the proper fill ratio.

We also needed to support one of the pathways of the cables coming to the rack from the 2nd floor hall. These cables had been run through the Drill team's equipment room, that did not have a drop ceiling to hide them. So, we decided to install ladder rack to support the cables. The other option of using 4" J-hooks didn't really appeal to us or the customer as far as the cosmetic aspects in a visible space.

IDF D

In this closet we needed to re-orient the rack back some to better cover the core hole that was added after the orginal rack was installed. We also installed new 6" x 6" Panduit verticle cable managers and also 2RU Horizontal cable managers were added. We replaced several of the older Cat 5 oversized patch panels with the newer 2 RU Cat 6 patch panels. We also added an 8ft Rack to replace the 7ft one. We also reouted some of the cabling from the way it was entering into the IDF and into the rack. Several cables crossed over and needed to be pulled out and relaced into new budles so that they flowed down into the right side of the rack and became more uniform.

IDF D with the finished look of the new 8ft Rack and new wire managers

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IDF E

Lee Solis owner of Cablelink -Texas going over the plan for the work required for IDF E.

In IDF E we had to deal with several other trade's cabling and piping that was installed around the network equipment rack as time went by. As you can see in the picture there is an unused metal panel that has a ¾' EMT pipe running through the data cable bundle. Another panel that is still in use for some building controls is behind the rack in the way also. We needed to install 2 new 2" floor cores and one new 2" wall sleeve to be able to re-route the cabling to cleanly enter the new 8ft rack. This also allowed us to achieve a proper fill cable fill ratio once again for the conduits. We also were able to once again to achieve separation in conduit with only data cabling in the cores. The cores made it easy for other trades to run their cabling between floors, but it created the problem of mixing cable types that could cause EMF interference for the data cabling. This was also one of the closets that had 50% of older white cabling and newer green jacketed Berk-Tek cabling. We moved the rack out away from that metal building control box. We also needed to get away from that large square airduct that was to close to the newer rack location, and taller 8ft rack. We also moved chains hanging the overhead florescent light. Since we installed the newer 8ft rack, the light was in the way. We added two new 2" floor cores one on each side of the rack to be hidden by the new 6" x 6" managers. So, now the only cable left in that old conduits were other trades building control cables, access control cabling and PA speaker cabling.
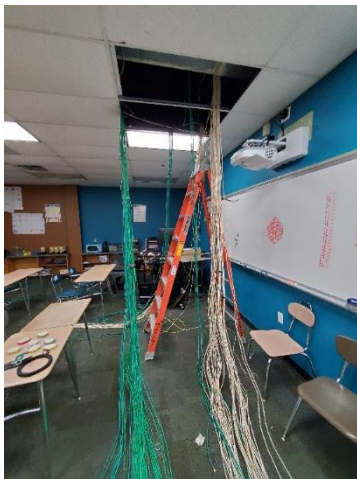
This picture is also from IDF E. This is the classroom next door to the mechanical room where the cables from the 2nd floor enter the top left side of the rack in IDF E. We replaced the existing 1-1/2" Sleeve with a new 2" sleeve. As you can see, we are pulling back the cabling so it can be re-routed with new J-hook pathways and grouped in more sensible bundles before it enters the new rack through the wall in the right side of the picture.

![CABLELINK SOLUTIONS logo]

IDF E. The new 8Ft rack with new 6" x 6" Vertical managers and all 2 RU Horizontal managers. The ¾" EMT pipe has also been removed that ran along the wall through the cable bundle. The fluorescent hanging light's chain hangers have been moved away from the new rack location.

![CABLELINK SOLUTIONS logo]

IDF G

This is one of the few closets that we didn't change out the rack and left the old unpainted aluminum 7 ft 2-post rack in place. We did redress the cables in to bundles and reterminated them onto new Cat 6 48- port patch panels. The most visual thing we did was install Vertical and horizontal cable management to clean up the look of the rack. Also took the time to mount the PDU at level. Something the original installers didn't do. I guess they forgot their level that day.

This is a small closet on the West side of the Main GYM area. It had only a single sided piece of latch duct screwed onto the side for vertical wire management. We used the 4"x 4" vertical managers here because there are not that many cables coming to this rack. We changed out the ladder rack to black to match the cable management on top and added a piece coming down the wall to the rack from where the cable bundle runs above the Air handler unit.

IN CONCLUSION:

Customers might not always be able to afford to go through with a total cabling upgrade. Due to cost or possible down time that it could incur. When that is the case, a closet retrofit might give an extension to a network cabling system's life span. Especially when they have had several generations of UTP cabling installed by several different companies over the years. That added a drop here and there and didn't properly dress in the cables with the existing bundles. These past installers might have only performed a simple map test on the cables, instead of performing a proper certification test on the cabling. Let's face it, the tester units to perform this advanced level of testing are expensive. However, that's the price of doing business if you want to properly perform this type of cabling work. Cablelink Solutions-Texas has invested in two of these expensive Fluke tester units as well as one Fiber optic module to allow us to also perform fiber optic certification testing for our customers.

Cablelink Solutions-Texas has the expertise to perform this type of work to help customers have a professional looking telecommunications closet. A Telecommunications closet that is properly terminated and with the proper cable management put in place. This matters because when network problems happen it saves your I.T. staff time. When they are working in a closet where the cabling is properly labeled and dressed. It saves them time in trouble shooting network issues that come up. Not

snagging themselves on hanging cables or patch cords. Knowing that the cable has been tested and certified to at least the cable's base category level with industry standard Fluke certification meters.

Cabling issues still account overall of almost 75% of all network problems. Why not reduce that percentage of possible headaches for your cabling system.

A retrofit might be the answer for you. It can help to provide the best overall performance possible without having to budget for the higher cost of a total re-cabling project for your network. Cablelink Solutions-Texas is the right partner to help you achieve that goal.