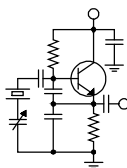


The Local Oscillator



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A Tale of Two Dishes (okay, more like six...)

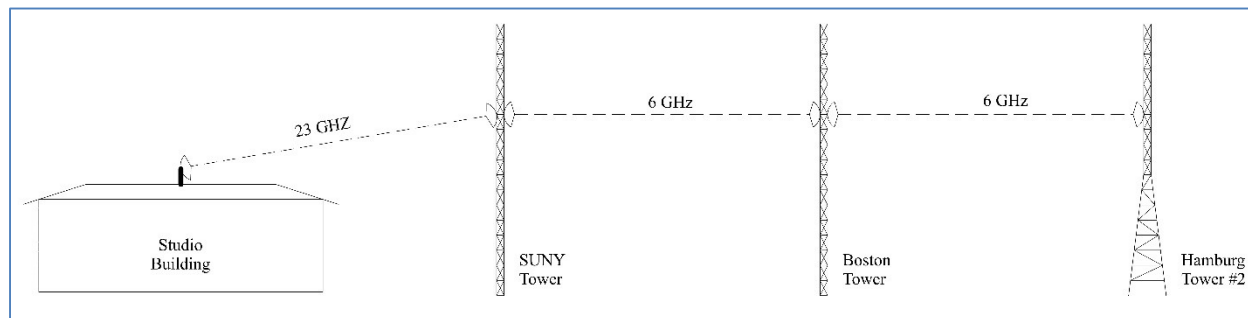
It was the best of times, it was the worst of times... the best of times because our decades-old Buffalo studios were getting not just a facelift but a completely new build in a new location in a building much newer than the old center city venue we had occupied since the 1960s. While we had rotated out old equipment on schedule and even rebuilt within the old leasehold with new cabinets and equipment a few years ago, it was still a tired old facility in a neighborhood that was in decline.

For several years, I had planned to replace our 950 MHz hybrid digital STL links with Part 101 point-to-point 6 GHz links that would provide a good data pipe to our two local tower sites, but for a

Hamburg tower sites, it would take a 250-foot structure to get terrain and tree clearance. Not going to happen.

Thankfully, there is a 443-foot tower owned by the State University of New York (SUNY) just a half mile from the new studio location. This tower supports a couple of full-power NCFM stations, four translators and a cellular array. We began talking to the SUNY folks in February of 2022 and eventually got the structural analysis done and a lease executed. From the 250-foot level of that tower, we had a clear shot to our Boston FM transmitter site.

The sketch below shows the architecture of the system. Between the studio rooftop and the SUNY tower, we use 23 GHz. From there to the Boston tower, we use upper 6 GHz, and we also use



number of reasons, including rooftop mounting structure stability (or lack thereof), I kept putting that off. The studio move forced the issue.

It was the worst of times because we had the hardest time getting the microwave system across the finish line. This was in part because of its complexity, but there were all kinds of aggravating factors in play.

The initial problem to be overcome from the new studio location was path. There is no tower at the new studio location, nor can we put one up, and because of distance from the Boston (NY) and

U6 from Boston to Hamburg.

Why did I choose these bands? 23 GHz works great for short-haul applications, and the studio-SUNY path is only a little over half a mile. There are few interference concerns at 23, and beamwidths are tiny (and so are the antennas at 12 inches). I would normally look at 11 GHz for the longer legs, but I chose upper 6 GHz for the other two legs because we needed the lower frequency to get the needed reliability with Lake Erie and its atmospheric effects nearby (the Hamburg site sits almost on the shore).

The other question you are probably asking is why we didn't shoot from SUNY to both Boston and Hamburg instead of daisy-chaining to Hamburg through Boston. That was certainly an option from a



The 23 GHz radio and antenna on the studio roof. The SUNY tower is in the background.

technical standpoint – we have a line-of-sight path from SUNY to Hamburg – but it would have required three antennas on the SUNY tower, and the rent there isn't cheap. There's no rent on our Boston tower (which we own), so I opted to chain from Boston to Hamburg. Will the reliability be less on that final leg

because of this? On the surface, it would seem so since an outage on the SUNY-Boston path will also take out the Hamburg link, but that risk is relatively small. With good terrestrial backups in place, the financial advantage far outweighs the risks.

Once the tower crew got aboard with our plan, there weren't many problems getting the studio-SUNY and SUNY-Boston paths up and running, but we did run into a problem when installing the antennas at the Boston site. I had used the 950 MHz STL antenna heights from the decades-old FCC licenses for the Part 101 link antenna heights, and when the tower crew located those elevations, they were in the lower aperture of the WDCX-FM auxiliary antenna! Clearly those licenses were in error, and the error had been propagated with every renewal since the 1960s. When we discovered that, we had to find a new elevation that would work, redo the coordinations and file modification applications with the FCC. Thankfully those minor changes were granted quickly, and we were good to proceed.

(Both those old Part 74 STLs were decommissioned when the Part 101 link was activated, so no need to mess with new coordinations and change applications for those links.)

The studio-SUNY and SUNY-Boston paths were aligned and we were able to start running traffic

over the links soon thereafter. That left the Boston-Hamburg link, and we ran into a lot of problems with that one.

I had initially selected tower #5, the southernmost tower in the five-tower diplexed WDCZ/WHLD array, to host the 3-foot 6 GHz antenna. I chose tower #5 because it was the low-power tower in both stations' 5 kW directional antenna systems.

As we were about to start the installation, we discovered that one of the base insulators on the free-standing tower was broken. I quickly found that getting that insulator replaced would be a months-long process, so I made the decision to move to the next lowest power tower, #2. Once again, I had to do a new coordination and file a minor change application with the FCC, and that was quickly granted. Brian had to move his NEMA boxes from tower #5 to tower #2, and that took some work.

Then when the tower crew began the antenna installation work, they found that the top of the 235-foot free-standing tower was moving around far too much to be of any use for mounting a microwave antenna. They found that the 135-foot level, where the tower is much wider, was more suitable, so once again I had to do a new coordination and minor change application. Again, the application was granted quickly, and we were cleared to complete the installation. With that done, the crew did the path alignment.

It was then, however, that we discovered that the power on the tower was not present full time. The photocell for the tower lights was on the transmitter building, and the contactor providing power to all the towers was actuated by that photocell. We needed full time power on the tower, so I bought the parts and Brian built from scratch a set of tower light controllers, complete with individual photocells, contactors and SSAC beacon flashers. It took some doing connecting those into the 80+ year old electrical systems on the towers, but he got it done, and now we have full time power on the towers.

At that point I figured that we would be good to fire up the link and start passing traffic, but when Brian opened the on-tower NEMA box that housed the 48-volt DIN rail power supply for the microwave radio, he found the roll of fiber-optic cable melted with arc marks showing to the door and back wall of the box. What the heck? How could a piece of plastic arc and melt? That's when I read the fine print on the specs of the armored fiber-optic cable I bought for that application. Turns out it had a stainless-steel wire inside the molded buffer to

provide lateral strength. Wow. So I ordered a new piece of UV-rated fiber, this time without the steel wire, and the tower crew installed it.

A few days later, when Brian had wrapped up the rest of the preparations at the site, we were again ready to fire up the link and start using it, but it was not to be. There was no data coming from the radio on the new fiber. Our initial thought was that the fiber was bad, but then we connected to the



Brian's tower light controller on Tower #2 at Hamburg.

management GUI on the radio on the other end of that link and found that it was not seeing the Hamburg radio. Clearly the Hamburg radio was down. We suspected a power issue. So back came the tower crew, and sure enough, they found they had reversed the polarity of the power connection to the radio. They flipped it over and the radio came right up, thank God! We had a link!

There was one more thing I found while Brian was fighting with the power issue. Aftermarket, off-brand SFP fiber transceiver modules will not work with Cisco Catalyst-series switches. Brian was using a Cisco Catalyst 2960-CX-8PC at the tower base, and it would not have passed traffic from the fiber had we had power on the radio. Once I figured out the issue on the bench in Denver with another 2960, I ordered a Cisco-branded SFP module, got it in and installed it in a new 2960-CX-8PC-L. That worked like a hose (we have a fiber setup in the Denver engineering shop that I use to set up and test microwave radios and other systems using fiber). So I shipped the new switch and SFP to Brian. And it worked fine.

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So on Wednesday, July 19, we began passing traffic on the final leg of the CBC-Buffalo microwave network.

It was an epic journey filled with trials and frustrations, but now we're 100% on our own infrastructure in that market, and it feels great! We still have some mop-up work to do, including getting our internet backup



Arced and melted fiber? WTH??

codes up and running and configured for automatic failover, but that should be a snap compared to what we've already come through.

I very much appreciate Brian and all his hard work in getting this project across the finish line. No doubt he learned a thing or two in the process, and as with the move to an all-digital AOIP facility at the new studio, I know he will appreciate having the connectivity to both sites and all the options that affords.

Keith Peterson

By now, many of you have likely heard that Keith Peterson, longtime engineer in our Denver market and corporate webmaster, passed away on Wednesday, July 26 after a long battle with respiratory illness.

Keith has been in our employ on and off since the mid-1990s. He was a smart, hard worker that never said no to an assigned task. He was a devoted husband, loving father of five, and most importantly, a devoted follower of Jesus. He is with the Lord now, and those of us who are also in Christ will see him again someday.

Please keep Keith's wife and children in your prayers as they transition this difficult time and adjust to life without Keith.

The New York Minutes
By
Brian Cunningham, CBRE
Chief Engineer, CBC – Western New York

Hello to all from Western New York! July was an extremely busy month with lots of projects getting buttoned up that have been ongoing for some time now. The longest running project was the Buffalo Cambium Part 101 microwave link that connected our new studios in Amherst to the transmitter sites in Boston and Hamburg, New York. Cris has covered this project in detail in his narrative this month, so I will not go into belabor all of the pitfalls we experienced.

The final leg of this project was the Ubiquiti PowerBeam link between Tower #2 and the WDCZ transmitter building. On Tuesday, July 18th, I set up the radios using the tutorial Cris has previously sent me, which worked like a finely tuned watch. Aside from a little azimuth adjustment, the radios locked on with good signal in both directions. Once the link was put on the air, our on-air sound improved, not that it sounded bad by any means, but that background internet sound was gone, with the audio clean, crisp and clear!



The dashboard screen of the Ubiquiti PowerBeam at the WDCZ transmitter site. This link carries data from the base of tower #2 to the transmitter building.

Another project we put to rest this month was the tower #5 base insulator replacement at the WDCZ transmitter site. You may recall that back in March, we were going to install the Cambium dish on

this tower, but when the day arrived to start the work, we discovered that the base insulator on one of the tower's three legs had cracked, making climbing the tower unsafe.

After making numerous measurements of the existing base insulator, Cris compiled all the data and sent it to Austin Insulator in Mississauga, Ontario to have a replacement insulator custom manufactured.

The tower itself was erected on-site in 1941, therefore there are no "off the shelf" replacement parts available, and Austin

Insulator did a remarkable job in making a new insulator.

On Monday the 24th, the crew from Farley Rigging, a local crane company, showed up to begin the replacement. Jeff Farley, the owner of the company, at first thought about lifting the tower using a crane, but after careful consideration, he determined that jacking up that leg would be the safest

and most economical way to get it done. He along with his son Luke and long-time employee Boomer,



The new insulator in place at WDCZ tower #5! The jack frame and cribbing are visible above and on either side.

began assembling the cribbing blocks that would hold the weight of the tower while lifting.

I must say that I was thoroughly impressed with their work, and how quickly everything went. It took about five hours to construct the cribbing that was on each side of the tower leg, and about three hours to jack up the tower and remove the damaged insulator. We were indeed fortunate that the weather cooperated with us, as a chance of thunderstorms were forecast each day, but not a drop of rain was to be seen either day.

On Tuesday, Jason Kardokus and Jack Olson arrived from Northstar Broadcast out of Sacramento, California to assist in the insulator replacement. These two guys have worked with CBC on several different insulator replacement and tower construction/maintenance projects, and they really know their stuff! It was quite reassuring to have them here for the replacement, as any number of things could have gone wrong. Having experienced, knowledgeable people on site was good insurance.

The entire project went without incident, and Jason and Jack were impressed with how everything went, with accolades to Jeff Farley and his crew for a job well done! They got the job done, and I made some new friends!

Another project put to rest early in June was the tower lighting controller installation on towers one, two and three at the Hamburg site. I fabricated the controllers and re-wired each tower to accept the new boxes. Working with 80+ year old rigid conduits and wiring was tough, as corrosion and who knows how many tower paint jobs made disassembly of the old system difficult. Compound that with near 100-degree heat index for days and this project just about got the best of me, but it got done! See the photo on page 3 above to see what one of the completed

scratch-built controller boxes looks like installed on a tower.

I must add, I had three electricians come out and bid on this project, but all three turned us down; they simply were not interested in doing this work. I don't know why they chose not to bid on this job. The electrical junction boxes were not that high up on the tower, with the highest being about 12 feet or so above ground level, easily accessible by ladder, so the height shouldn't have been an issue. I had the controller boxes pre-wired, so there was not much additional work they had to do. Guess they figured it was not enough work to bother with bidding on it.

We finally received all the bids for the replacement of the failed WDCX transmitter site standby generator. R.B.U'Ren, our usual generator sales/service contractor, came in with the best bid, and believe it or not, projected about 12 weeks for delivery! They will be installing the new generator and transfer switch, a Gillette 100 kW rig with a John Deere 4-cylinder diesel engine, as soon as it arrives at their facility in Niagara Falls.

The only downside of the new generator package is the fuel tank size. Our current diesel fuel tank will hold 325 gallons of fuel; the new generator tank only has a capacity of 266 gallons. Next year, we might think about purchasing a standby 140-gallon storage tank for diesel fuel. Being that far out of the city and located on a rural road that doesn't get much maintenance during the winter months. It just makes sense to have additional fuel stored on site in case of a prolonged outage due to substantial snow accumulation.

That about wraps up another month here in the great Northeast, and until we meet again here in the pages of *The Local Oscillator*, stay safe, and happy engineering!

The Motown Update
by
Mike Kernen, CSRE
Chief Engineer, CBC–Detroit

August is here and so is the, wait, what? Rain you say?? Yes, we've had more dadgum rain than I can ever remember. The grass, she is a growin' and the fields, they need a mowin'! I've been way too busy for that given that we've had so many headaches and projects.

Studio Telephone over AES67

Last month, you heard about the Telos VXs and how it runs on our spanking new Docker server which runs a containerized environment provided by Docker running on a Linux distribution known as Ubuntu.

Now, I'm certainly familiar with Telos legacy POTS gear all the way back to Steve Church's Telos 10. Heck, I even had a twin server 2101 and the large and in charge triple-redundant hardware VX system from Telos that used a Linux based VOIP management system called Asterisk. As an aside, if you leave one of the three \$6k+ Asterisk servers on top of a trashcan, you will find yourself combing through trash at a dump downriver. Yes, he found it, yes it was ruined, no, I didn't do it. Don't ask.

We have the VXs working as of this morning. We ran into issues with outbound call routing, which turned out to be simply some well-hidden inbound spam call blocker on my cell phone. I still haven't found it. It must be something at the carrier level that's identified our outbound as "spammy" and simply returns a busy signal. Unfortunately, this fooled us for a while, and until we thought to try a different number to call to make our test calls, we kept thinking we weren't getting routed correctly. I'll deploy the VSet6 phone to the studio next week and we'll start using the system.

Transmitter Site Storage Building

The Huron Township (WMUZ-AM) storage building is nearly complete. We had our final inspection from the township with the only directive being to add fill dirt to the sides and rear so that the foundation was not exposed and to drain water away from the building. I ordered 12 yards of fill and sloped the soil from the edge of the building down to the nominal grade. It looked fantastic and I thought

I'd throw some seed on it to stop future erosion, but I was no sooner finished when a torrent of rain came and made a muddy mess of it. It's still adequate for the intended purpose, but certainly doesn't look the way I'd wanted. I gotta get some grass growing!

Next on the list for the building is some electrification. Some overhead high-bay lighting, a couple of outdoor floods, a few receptacles, and a couple of extra security cameras are in the plans. I'm also trying to extend the alarm system to the new building, but it may be that the system we have won't support it.



Studio Generator Project

Our new Generac 150 kW natural gas generator is still not in service because when we attempted factory commissioning, the technician suspected and subsequently measured inadequate flow from our natural gas supply. Despite our initial investigation, which indicated we'd have an adequate supply, testing the new generator under load caused a very significant pressure drop. Presumably, this is from the inadequate diameter of the underground pipe. It's possible that the existing pipe is damaged, causing a restriction, which could account for why the old generator failed and possibly even why we've had some roll-out on the heat-exchangers on our rooftop HVAC units. We've even had issues keeping our water heater lit. There's definitely something wrong necessitating this line's replacement.

As it stands, we are awaiting movement from our natural gas utility. It's something of a black hole where the customer-facing representative forwards your specs to the engineering team, who's no doubt tasked with stacks of projects work through them in FIFO order.

What's apparent is that we need to have a larger feedline brought in from the main road. What's not apparent is on whose dime that will be. According to the title researchers, there's a public easement (right-of-way) that terminates in our parking lot, so hopefully we'll only be responsible for the short run from that point to our meter. In typical public utility company fashion, they're slower than molasses in January.

NexGen Headscratcher

I have run into a couple of issues of late that are real head scratchers. One of our NexGen servers has developed an intermittent skip in its audio. It'll play for hours without a problem, or the audio will just be garbage – broken and full of what I believe are buffer underrun issues. Buffer underruns occur when the sound device, or in the case of Wheatnet, the software driver, is not being fed data at a rate adequate to keep it from running out of data as it streams. Wikipedia describes it this way: “In computing, buffer underrun or buffer underflow is a state occurring when a buffer used for communicating between two devices or processes is fed with data at a lower speed than the data is being read from it.”

Why is this happening? The computer's processor is so busy with other tasks that it can't keep up, so it's not servicing the subroutine that keeps the sound driver supplied with audio data often enough.

In today's computer hardware, we have processing power adequate to feed hundreds of audio streams simultaneously, so why? We can see on our other machines that the processor is loaded by the NexGen process (known as Coyote) by about 0.6%, but on the computer having the issues it's closer to 30%, and it never decreases. We also see on other NexGen computers that they generally have 15 to 20 processor threads at any given time. Our problem computer builds a new thread every time a new audio cut is played and never seems to terminate old ones. I've seen the thread counter over 300, which could explain why after restarting Coyote, the system audio is fine for quite a while, then in a day or so, it goes to crap.

The RCS (NexGen) support people have no notes in their system on this, suggesting that they've not seen it before. We tried a bare-metal restore on the otherwise new computer with fresh installation of

NexGen, and the problem was immediately evident; still roughly 30% CPU and threads never terminate. I grabbed an old NexGen computer from our storage shed, and as soon as we configured it for the appropriate radio station, it began to exhibit the same erroneous behavior. I've changed out the network cables and switch ports, too. So, what's next?

I've encouraged the technician to escalate this problem to the dev team. Someone must know how this works and can offer some suggestions. There must be something wrong if it's the data that's being restored from the file server that's to blame. We plan to build the station back from scratch using none of the stored data to re-form this station profile. Wish me luck!

Wheatstone Unintended Operation

Because one ghost in the machine is never as fun as two, the Wheatstone LXE console in the FM control room has developed its own intermittent issue. Headscratcher number two. I'm using the console's Aux Sends (not to be confused with its AUX bus) to develop a mix for recording phone calls into our VoxPro.

This has worked without issue for two-plus years rock steady. All of a sudden, it has started to deselect the AUX Send ON function, interrupting the host mic's feed to the VoxPro. Naturally, this doesn't happen in other studios, and the Wheatstone support people don't have any reports of this happening, either.

I've saved the configuration in all of the events (what Wheatstone calls their console profiles) and shown the morning host how to recall these so he can restore the audio feed, but it keeps happening. For now, I put the VoxPro's host audio on a different Aux Send. Hopefully this one doesn't shut off randomly.

News from the South
by
Todd Dixon, CBRE
Chief Engineer, CBC–Alabama

WYDE-AM and an All-Digital Future

In the middle of June, Cris told me that the company was considering taking our 5,000 watt day/41 watt night WYDE-AM signal completely digital. Part of that transition was doing some testing during the experimental testing period. I called Nautel and verified that really only two things have to be in place – the Exporter Plus has to be placed into MA3 mode, and I needed to create a preset on the NX5 that is HD-only.

I got to the site just before midnight and began to get everything in place. After a reboot of the Exporter Plus and switching to the preset I had created ahead of time, we were on the air with a full-digital MA3 HD signal.

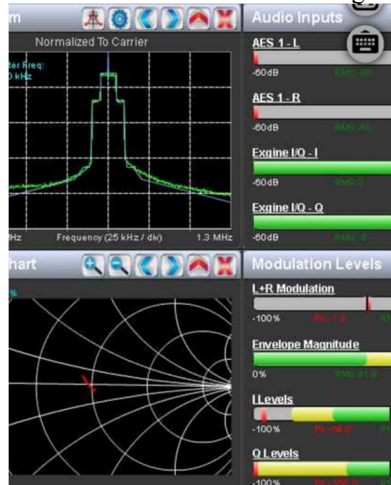


Figure 1 - The Nautel NX5 transmitting in the MA3 all-digital mode.

anticipated is not being able to listen to it on my Kenwood HD radio receiver in my van. Despite knowing that we were modulating and seeing the digital spectrum displayed on the transmitter, I simply couldn't pick it up with my radio.

As luck would have it, last year about 10 days before I became chief engineer here in Birmingham, the factory radio in my Dodge Caravan

died. It wasn't HD anyway, so I decided to purchase a unit from Crutchfield that did have an HD receiver, and it works great on FM HD and even AM HD in

MA1 mode. What it can't handle, apparently, is MA3 AM all-digital.

After having to report to Cris "I 'think' it was working," he had me get in touch with Jeff Detweiler at Xperi about a possible cause for this. Obviously, we wouldn't want to change over to an all-digital broadcast if a high percentage of people that had HD tuners couldn't hear it. I gave Jeff the model number of the receiver and he confirmed that it did indeed have a chipset in it that ended up in about 50,000 out of 100,000,000 receivers

that wouldn't be able to tune in the full AM digital only signal.

Armed with that knowledge, I tried another night with a Sparc portable HD radio that we have in Birmingham. I replicated everything, and the Sparc immediately tuned in the all-digital signal. I drove around the area for about an hour and the audio was extremely clean. It dropped out on several occasions exactly where our analog signal drops out, so overall it was a productive night.

We started airing a local public announcement on July 14th regarding the change to all digital for WYDE-AM. We have to run the announcement at least 6 times over the course of the month. Starting on September 1 (or 30 days after the FCC puts our all-digital notification on public notice), we'll officially begin broadcasting in digital-only mode and I'll be trying to find one of the 99,950,000 receivers that can pick up the all-digital broadcast...

WiFi Network Security

It's with a little bit on embarrassment that I write this portion of this month's article. For everything that I know about computers and networking, our WiFi network had been put together with expediency in mind and had not been well thought out. Even though we had enough horsepower to do everything with four Unifi access points in the building, they were all broadcasting

their own SSIDs, and if you'll excuse my pun, they weren't unified. If you went from one end of the building to the other, you had to log into a separate network (which had the same password). We didn't have a guest network set up, so I'll leave it to the reader to guess which WiFi network they were using to access the internet.

As with almost anything in life, pain is often highly motivating to encourage you to try and find a better solution and to remove the irritant from your life. One of things that has cropped up in Birmingham is that several of our clients that pay for time have purchased Logitech Mevo cameras and have begun to use them to broadcast their shows out to various social media outlets in a "live" fashion. The main issue was that the two different studios that have clients in them that do this are also right across the hall from each other, are on the air at the same time, and oh yeah, they each have a set of three cameras in each studio. So the WiFi in the one corner of the building truly was a "hot spot" and would flare up like a solar storm every weekday afternoon.

Unifi has routers and other equipment that work seamlessly to make all of their access points work together (along with cameras, doorbells and a host of other features). I didn't have one of those, but I did have a spare computer that I could host their network controller on and then have it interact with our ClearOS firewall. I spun up an Ubuntu 22.04 long term release and followed a tutorial for self-hosting the controller locally on our network. It basically sets up a web GUI that you can go through and adopt the access points it "sees," sets up different WiFi networks and assigns the created WiFi networks to each access point.

Because the access points were in such disarray, I had to reset them all to their factory defaults one at a time and adopt them into the controller. On the GUI, you can then assign the WiFi networks you've created to whichever access points you want. In our case, we ended up with five networks: CBCSummit, CBCGuest, WYDEstudio, WXJCstudio and WDJCstudio. CBCsummit is for employees only and has access to all of our network resources and is on all five of our access points.

So now employees don't have to log into different networks in different areas of the building. CBCGuest is an internet accessible network, but it is also an isolated network that is on all five access points. The three XXXXstudio networks are similar to the CBCGuest network, but only available on the access point that are closest to each studio and are really only meant for the aforementioned cameras.

The tricky part of the whole thing was providing a separate IP network to each WiFi network that was created. For that, on the controller each network needed to be tagged with a VLAN

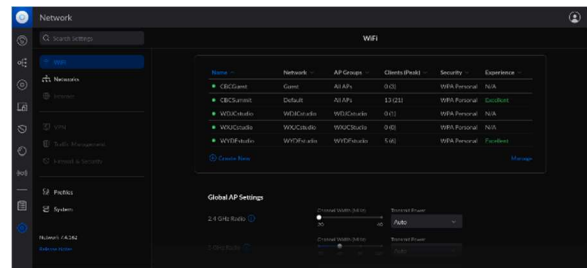


Figure 2 - The Unifi network controller shows which WiFi networks are attached to which access points.

number and that had to follow all the way through the network. The switch port that the access points are connected to needed to be able to pass those tagged VLANs as well as the port connected to our ClearOS firewall. This meant logging into the switch and adding the VLANs to the proper ports.

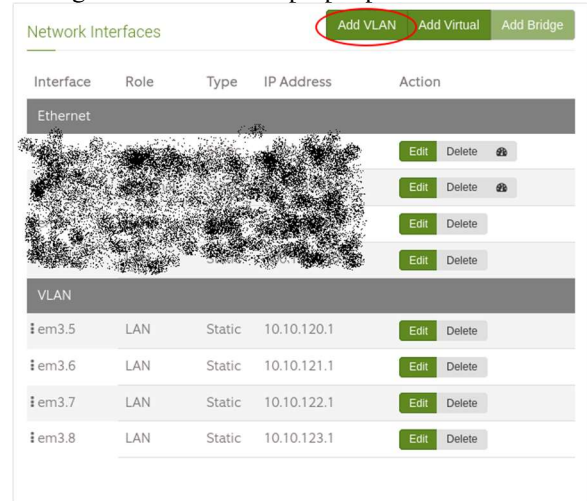


Figure 3 - ClearOS allows you to create VLANs for segmenting networks.

The last leg of these virtual networks was ClearOS firewall itself. In the IP settings menu, there is a button for Virtual LANs and I ended up creating four additional networks with DHCP IP provisioning so that when the guest or studio networks are used, they would provide host IP addresses that are on totally different subnets and completely separate from our main LAN.

The results are that our main LAN network has moved from a confusing hodgepodge of individualized area networks to a unified whole. We

have a legitimate guest network that allows internet but keeps guest machines and devices isolated from the rest of our network. Finally, we have real studio network segmentation so that each studio doesn't mix and match between each other and create a congested

mess.

I hope this helps to inspire you to try and clean up the mess that WiFi can become and get more secure as well. God's Blessings on the work of your hands and we'll visit again next month.

Tales From Cousin IT
by
Stephen Poole, CBRE, AMD
CBC Corporate IT Specialist

Ah, Alabama, the home of endless weather. You just think you have weather where you are; I assure you, we have more and better weather here – "better" being a relative term (and given some marriages here, that's all we'll say about relatives).

In July, we had some severe storms, with lightning, hail and high winds. But we've mostly just had a bunch of rain. LOTS of rain. Roads flooded or washed out, trees down, that sort of thing. But adding to the joy is that Alabama features special breeds of mold that come in two flavors: green and black. You'll see this on houses, trees and slow-moving dogs – any surface that doesn't get direct sunlight. Once this gets into your home, it's an expensive nightmare to get rid of, too.

During my tenure as Chief Engineer in Alabama, we managed to keep the mold (mostly) under control. This was made easier because all of our transmitter buildings are sealed and air conditioned, which keeps the humidity down. But it's still a never-ending battle for Todd and Jack. Corporate never responded to my requests for a flame thrower to help address this, which left me with hurt feelings and a sad heart. But God is good, and I'll get over it. Maybe.

Two-Factor Authentication

... or "2FA," if you're into the lingo. This was added to our online POR system a few weeks ago. It's a relatively simple (though very secure) method that uses email. When you log in now, you'll be sent a one-time code that must be entered before you can proceed.

I've received a couple of complaints/queries about this; nothing major, mostly just, "What's going on?" All of our partners have taken this in stride, which is a blessing. But I also added a function that

locks you out after three bad attempts at either the password or the one-time code. This has tripped up a couple of users, but again, nothing major.

Why Reboot?

Here's another example of way more information than you want, but it's actually kind of important. All of us have at least one piece of equipment that requires an occasional reboot to operate properly. The most common symptom is that it just appears to hang or stop working after being on for a while; typically many days, sometimes even months. You

switch it off, count to five, then switch it back on, and it's fine – for a while. Rinse, repeat, wipe hands on shirt.

My background is somewhat different from many other broadcast engineers: yes, I can twirl knobs, repair equipment and design studios, but I'm also a system and embedded-level programmer (whence my move into Cousin IT's cabin). If you've ever received a big transmitter tube that was packed in that hard spray-in foam, there are special machines that heat that goo to the correct temperature, then spray it around the tube. I once wrote firmware for just such a machine on contract to a company in Kalamazoo, MI. So, who knows? Maybe my code set up the foam around your 4CX20000!

The point is, whenever I see an issue with a digital device, I consider both software and hardware. You should start by ruling out obvious problems with the hardware: is it getting hot? Maybe you need to do some cleaning; a heatsink covered with dust is like wearing a fur coat on a hot day. Maybe the power supply is glitchy. Or, maybe it's an intermittent hardware fault, say, a RAM stick or a plug that isn't quite pushed in all the way. Once you've eliminated the obvious, you may need to call the vendor for support. If it's a truly weird problem (what we



Alabamans might call "a good 'un") don't be surprised if they're as baffled as you.

Now for the software. I get to introduce a geeky term that will amaze your friends and co-workers; feel free to let it roll off your lips with flair.

Resource Leaks

No computer, whether a tiny little device in an audio codec or a big file server, has unlimited resources. We can load a big server with RAM and lots of high-speed storage to help mitigate issues, but smaller devices like an audio codec or remote control are seriously limited in what they have to work with.

From a programmer's perspective, this requires care. Simply put, if I grab a slab of memory, I have to free it when I'm done so that it can be reused by something else. If I don't, we'll get what the geeks call a "memory leak." The problem won't show up right away, which makes it fun to track down.

Your big clue here is that the hardware seems OK, and the problem only occurs after a good bit of time has passed. Memory (or some other resource) is allocated for something, used, and then never released. A bit later, more memory (or whatever) is grabbed and never released. After a while, that little device will run out of a critical resource. Time to reboot. It's interesting that some remote control vendors now offer on-off AC switches so that you can do this remotely.

We programmers have access to tools that can check our code for allocate-but-fail-to-release errors. Some programming languages are much better at doing this automatically (Google "memory garbage collection" to see some examples, if you're curious; Java/Javascript, Python and PHP all do this). But the problem is especially severe in a small embedded device; the resources are so limited that if the programmer misses freeing a resource, the device is going to suffer "leaks" and will eventually stop working.

Look: I don't mean to cast aspersions on the fine people that build the stuff that we use in broadcasting. But the fact is, their "programming department" might only be one or two people. Languages that support automatic garbage collection, by their very nature, need more memory than those that don't. C++ and C, two very common languages used in embedded applications, are good examples of those that don't. They create lean and mean firmware, but the programmer has to take care of the details.

As an end-user, of course, the only thing you can do is ensure that the latest version of the firmware has been installed. You should also ensure

that you have a known-good previous version that you can fall back on if the latest update doesn't work.

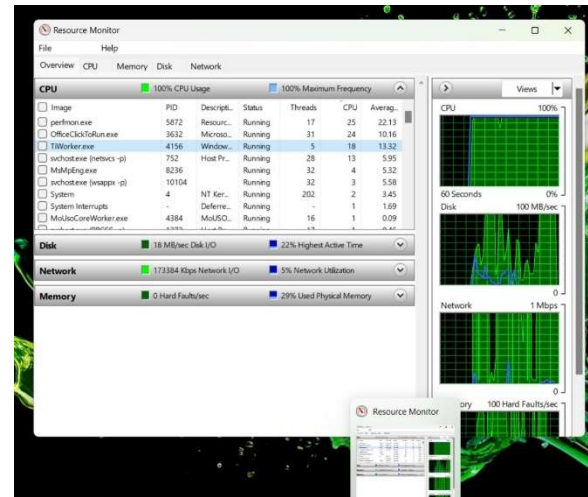


Figure 1 - Using Windows tools to check system behavior.

Desktop Workstations

... and laptops, office PCs, etc., and so on.

Make sure that you're getting updates and that they're functioning correctly. If a machine is glitching, once again, check the hardware first. If you're satisfied that it's OK, most operating systems include a bunch of tools that you can use to examine system behavior.

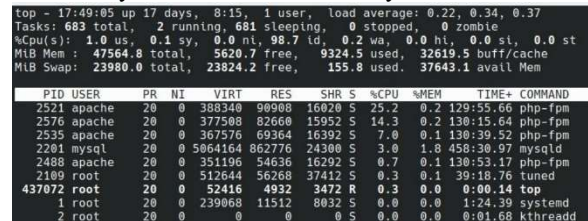


Figure 2 - Sorry, I prefer Linux – everything in one terminal screen.

In Windows 11, look for the Windows Tools and click to open. The Event Viewer can be used to look for faults with specific programs and resources. The Resource Monitor (Figure 1) will show you who's using what, and in what quantity. You might see one or more processes that are hogging memory or network access. That can help you zero in on the problem. Google "Windows Tools" for more information. If you're responsible for the Windows machines in your facility, you need to spend a lot of time getting familiar with these.

In Linux, which we use on our corporate servers, I do most of my troubleshooting in a

terminal. Figure 2 shows the output of the "top" command on our web server. Not surprisingly, the busiest processes are all associated with serving web pages: the top three lines in the list are the PHP engine, which builds web pages on the fly. The fourth line is the MySQL database, which is also used for web page construction. It's not surprising that these use a lot of CPU.

At any rate, if a Linux PC slows down, one of my first steps is always a quick "top" in a terminal to see if anything is hogging resources. I'd like to say more about troubleshooting problems with your operating system's built-in tools in later issues, Lord willing. Until then, keep praying for this nation!

The Chicago Chronicles
by
Rick Sewell, CSRE, CBNT, AMD
Engineering Manager, CBC–Chicago

In July, we got into the thick of the installation of a brand new Nautel GV30 transmitter. This would be our third GV transmitter here in the Chicago market that we have installed. Our first GV was a GV5 at the WSRB transmitter site five years ago, and then three years later, we followed that with a GV20 at the same site to be used not only as a backup for the GV5 but as a fairly full powered auxiliary site for WPWX.

Being that this was the third GV transmitter that we had installed, we had a pretty good idea of what needed to be done. As always, I and the crew look forward to a project like this. It's always exciting to be a part of new installation that could be here at that site for another 30 years. So, you want to do everything right and by the book. That is what we strived for, and I believe we can say that for the most part it was achieved.

Beyond moving something that large into the building, the most difficult part was the connecting of the three-phase 208-volt supply. Due to the position that the transmitter occupied, it brought the opening for the AC right under the wire bridge for low voltage connections on the site. We couldn't use hard conduit, and flexible conduit was the key, but even that was more difficult than originally thought because it had to fit between horizontal runs of the wire bridge. It was a little like wrestling an anaconda, as if I actually knew what it was like to wrestle an anaconda.

The RF plumbing only involved a fairly short run from the GV30's RF out port to the antenna/coax patch panel, not more than 12 feet away. The real difficult part in this installation was that the transmitter's port was on the opposite side of

the patch panel from the transmitter, and we had to dodge a lot of obstructions. This meant we needed a double-elbow connection coming up from the port of the patch panel and then lining up correctly with the transmitter port.

I was afraid that I would really get stuck with having to make some kind of short piece of pipe between the elbows. As it turned out, the double-elbow connection lined up almost perfectly in the hole between obstructions and parallel with the GV30 RF out port. It wasn't perfect, as the horizontal run between the transmitter's port and the double-elbow was not exactly running parallel, maybe at the most 5 degrees off. Hardly noticeable unless you're looking for it. Considering what I might have had to do I was feeling blessed!

When I am making my hard-line cuts, I usually not only measure twice, but I leave about ¼ inch extra in length, especially the center conductors. This has saved me from wasting expensive copper lines. If I have to cut a little more off, so be it. What's another 15 minutes when you're installing something that might be in service for the next 30 years?

I always figure that if the last piece you have to install is not difficult to get into place due to tightness, you are probably running a little short, especially critical for the center conductor.

I believe that is part of the reason that we have an exceptionally low VSWR on this installation. The previous transmitter on this specific port of the patch panel going to the main antenna saw about 22 watts reflected. I think a good deal of that might have been on the run from the transmitter to the patch panel.



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Per normal accepted procedures, we ran the transmitter into the dummy load and saw almost zero reflected power until we got it to about 10 kW. After that, we put it on the air and were very happy to see



20.7 kW forward and 3 W reflected. Nice! And the spectrum and constellations look good, too!

that we were getting an amazing VSWR of 1.02:1. With -14 dBc injection of HD signal and at 20.7 kW TPO, we had three watts of reflected power. After running for a few more days, there were times I saw the reflected power at two watts.

We are, of course, getting compliments from the programming staff on the sound of the new transmitter. I haven't had time yet to drive the signal, but our program director has and is very pleased with the performance and sound.

The one thing we really need to do, and we are having our HVAC contractor come out to do it, is install an exhaust hood on the transmitter so that we can take most of the heat out of the building. There exists an opening and pipe leftover from the previous transmitter in that spot. The plan right now is to get an inline fan and install the hood to meet that pipe. We're into the hot part of the year and this will be critical.



Rocky Mountain Ramblings

The Denver Report

by

Amanda Hopp, CBRE
Chief Engineer, CBC - Denver

August here finally here and that means VACATION! Those of you who have read *The Local Oscillator* for many years know that in August, we go on our family vacation to Lake City, Colorado, a tiny former mining town in Colorado's beautiful San Juan Mountains. It's a week filled with fishing, ATVing, and relaxation. But for now, we can reflect on the month that was July.

Mowing

I was able to mow some more at KLZ. Both KLZ and KLVZ have grown up a lot. You can't even tell I ever mowed at KLVZ back in early June. All the rain we've had this year has extended the growing season. We can usually just let it grow, wait, and before we know it, the rain is done and growth has stopped, then we can mow just one time. This year, it'll take at least one more time around the sites to get things back to looking decent and being fire safe again.

I didn't mow the whole site at KLZ, I just mowed a path to each tower and attempted to finish clearing inside the tower bases. The brush hog blades were dull, so I had to go slow enough to allow it to cut properly. The blade on the Stihl trimmer was dull and the plastic blade I have for the battery-powered Ryobi trimmer had broken and the string wasn't doing much. It was a long, hot day. I was able to get the paths mowed along with getting most of the tower base areas cleared. I have plans to go back out soon to finish up now that I have replacement blades to use.

I also have help as I have hired a gentleman, Chris Hamilton. He is new to radio, coming from IT in the banking industry. He has a knack for this stuff and has been working with another engineer around town to learn the broadcast engineering business. I need the help with maintaining the sites and figure this will also allow him to learn radio. Of course, he is getting thrown into the crummy work with mowing for now, but mowing is just as important as

transmitter maintenance in my book. I look forward to helping him learn how things work and hope to train him up to be a good engineer that I, along with others around town, can call on to help when needed.

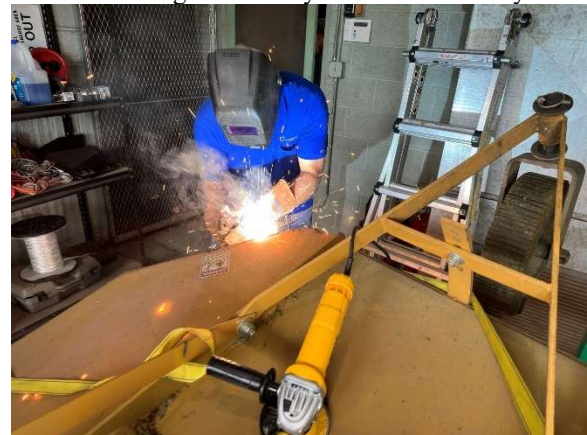


Tractor Woes

That Kubota tractor gets beat up. We have prairie dog holes around each site and some of them you don't see until it's too late, especially when the grass and weeds are three feet high. This can rock the tractor pretty good. Plus, equipment

like this tends to have issues with all the use we give it.

For a couple years the brush hog has had a piece of the rear housing that has become partially detached and is in danger of breaking away. So, my dad decided to give our 60-year-old welder a try. I



My dad used our 60+ year old Hobart arc welder to fix our brush hog.

think the last time it was used was when we had a contractor friend come out and weld up our old brush hog which had a similar issue. He was able to get it welded back together, but a use of the tractor later broke it. So, after watching some YouTube videos my dad got some ideas and welded it again. We haven't used it yet so we will see if the weld holds.

On his first time mowing with the tractor, Chris found some three-point hitch linkage had broken, making it so the brush hog couldn't be raised properly. He had to limp it back to the building, all the while scraping the dirt with one side of the brush hog. I was able to order the parts and we got it replaced fairly painlessly.



Broken linkage on the three-point hitch.

ESET Issues

Sometime in the middle of July, ESET did an update (or so I'm told) that was supposed to make things more secure. Instead, what I have found is that it made things worse. We had set up rules to allow certain things in NexGen and Wheatnet to run. After dealing with an unrelated issue in Wheatnet, I noticed several PC drivers had the question mark symbol showing in Navigator. It was only the computers that have ESET installed: control rooms and production rooms here in Denver. I checked and things in the room were working, which took some pressure off. I could see in ESET that it was blocking various things, so I unblocked them, which worked... for a short while. If I restarted the Navigator program or the computer on which it runs, ESET would block those things again. I went into the policy that the system uses and added this stuff into it and got the same result.

I finally contacted ESET technical support

and was told about the update and what the fix was. The fix did absolutely nothing. I was able to get on the phone with tech support, who remoted in. We walked through everything and tried numerous things. We finally created a new policy that we could test with and added the proper parameters needed and assigned it to the computers. This worked! We called it good, knowing I'd go in after the call to move what we did to the policy we use for the machines. Once I did this the question mark came back. I put things back to the test policy and called it a night.

The next morning, I did the same thing with the same result. I scheduled another call with ESET support, but continued poking around. After lunch I enabled the correct policy and unassigned the test policy and it worked. Did I change anything? No. I left the policy exactly as it was with the added parameters to allow Wheatnet through. This time, though, it woke up and so far, things are still working. I am still seeing some VNC servers getting blocked on some computers, but for the most part things seem to be working.

I don't know if ESET did an update (the program did update during this process) that corrected the issue or if it was just being temperamental. I will begin checking on our other markets who were seeing the same thing and see if things started working for them. If not, I will add the same changes to their policy and get it working again.

Keith Peterson

Now some sad news. Many of you know Keith Peterson. He has been around Crawford for over 20 years now. He first worked with Ed Dulaney, assisting with various activities. He left for a time, and when I took over as chief engineer in 2008, he came back to help me. He would help me with keeping the transmitter sites mowed and cleaned up so that I could focus on the studios and technical stuff. He also did a lot of the website work for most of our websites (corporate and station).

Several years ago, Keith was diagnosed with COPD and has been steadily declining. This year, he began getting worse and unfortunately, on July 26 at 11:15 PM he passed away. Please keep his wife Zenya (Rene) along with his kids Riley, Seth, Keith ("Just Keith" as we call him), Taylor and Ten all in your prayers as they navigate through this loss.

I'll leave it at that for this month. I pray you all stay safe and well and remember to hug your loved ones.



Our dear friend Keith Peterson. Until we meet again...

The Local Oscillator
August 2023

KBRT • Costa Mesa - Los Angeles, CA
740 kHz/100.7 MHz, 50 kW-D/0.2 kW-N, DA-1

KNSN • San Diego, CA
1240 kHz/103.3 MHz, 550W-U

KCBC • Manteca - San Francisco, CA
770 kHz/94.7 MHz, 50 kW-D/4.3 kW-N, DA-2

KLZ • Denver, CO
560 kHz/100.3 MHz, 5 kW-U, DA-1

KLDC • Brighton - Denver, CO
1220 kHz, 660 W-D/11 W-N, ND

KLTT • Commerce City - Denver, CO
670 kHz/95.1 MHz, 50 kW-D/1.4 kW-N, DA-2

KLVZ • Denver, CO
810 kHz/94.3 MHz/95.3 MHz, 2.2 kW-D/430 W-N, DA-2

WDCX • Rochester, NY
990 kHz/107.1 MHz, 5 kW-D/2.5 kW-N, DA-2

WDCX-FM • Buffalo, NY
99.5 MHz, 110 kW/195m AAT

WDCZ • Buffalo, NY
950 kHz/94.1 MHz, 5 kW-U, DA-1

WDJC-FM • Birmingham, AL
93.7 MHz, 100 kW/307m AAT

WCHB • Royal Oak - Detroit, MI
1340 kHz/96.7 MHz, 1 kW-U, DA-D

WRDT • Monroe - Detroit, MI
560 kHz/107.1 MHz, 500 W-D/14 W-N, DA-D

WMUZ-FM • Detroit, MI
103.5 MHz, 50 kW/150m AAT

WMUZ • Taylor - Detroit, MI
1200 kHz, 50 kW-D/15 kW-N, DA-2

WPWX • Hammond - Chicago, IL
92.3 MHz, 50 kW/150m AAT

WSRB • Lansing - Chicago, IL
106.3 MHz, 4.1 kW/120m AAT

WYRB • Genoa - Rockford, IL
106.3 MHz, 3.8 kW/126m AAT

WYCA • Crete - Chicago, IL
102.3 MHz, 1.05 kW/150m AAT

WYDE • Birmingham, AL
1260 kHz/95.3 MHz, 5 kW-D/41W-N, ND

WYDE-FM • Cordova-Birmingham, AL
92.5 MHz, 2.2 kW/167m AAT

WXJC • Birmingham, AL
850 kHz/96.9 MHz, 50 kW-D/1 kW-N, DA-2

WXJC-FM • Cullman - Birmingham, AL
101.1 MHz, 100 kW/410m AAT



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