The Local Oscillator

The Newsletter of Crawford Broadcasting Company Corporate Engineering

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The past month has been nothing if not interesting… in the Chinese proverbial sense, that is. We are indeed living in interesting times.

Detroit Line and Antenna

Regular readers may remember from last month's issue that we had some ice issues across our Midwestern markets, which folded back the power on transmitters and, we thought, might still be causing some issues with the main antenna at WMUZ-FM in Detroit.

As it turns out, while the ice did cause power to fold back for a time, the ice was not the problem there. Once the ice was off the antenna, everything ran fine for a few days before the reflected power jumped way up and stayed high. It took some time, as in a few weeks, to get a tower crew up the tower to do a thorough inspection. While we waited, we shipped our Tektronix time domain reflectometer (TDR) to Detroit and Mike Kernen took a shot of the line. He immediately noticed some problems at about the 200-foot level.

Once we got a crew up the tower, they found some discoloration on the outside of the transmission line at that level, and breaking the line open, they found evidence of arcing. Another TDR shot indicated impedance anomalies for 50+ feet above and below that point as well.

That Dielectric 3-1/8" rigid line is 38 years old, as are both antennas and the auxiliary line. All of that was my first project when coming to work for this company almost 39 years ago. The line has been vibrating, flexing and thermally expanding and contracting all those years. Undoubtedly some chafing was taking place internally, primarily where the inners mate to the bullets, and that chafing produces microscopic metal shavings that settle on the Teflon disks at the bullets. It was at one of these places that the arc occurred, and that produced soot that propagated through the line.

We have a good stock of line parts in a couple of different markets and could have pulled together enough parts to fix the existing line, but considering the age of the line and the importance of the station, we have opted to replace the line outright and reset the clock. And while we're at it, the antenna, an end-fed and pattern optimized SHP-4, is also 38 years old, so we're replacing that, too. Both new line and antenna have been ordered. We also ordered some rigid line parts to replace the pieces between the top of the vertical run and the input of the antenna, a jog that requires three elbows and a short horizontal run.

The line, RF Systems Heliflex 300, should ship early this month while the antenna won't ship until late this month. We will very likely deal with the line and antenna replacement as separate projects in terms of tower work.

In the meantime, the auxiliary antenna, which is identical to the main but 40 feet lower on the tower, is working fine, running at full power (50 kW).

Mike has a lot more detail on all this in his column, so read on.

Birmingham

As if that wasn't interesting enough, we had a break-in to the WXJC(AM) transmitter site in Birmingham last month. Three miscreants walked into the site early on a Monday morning and under cover of darkness, climbed up on the roof and hacked their way through the eave vent of the transmitter building and got into the attic. At some point, the burglar either fell through the drop ceiling to the floor below or put his foot through it – the excess loop of unused 7/8" transmission line for the old 950 MHz STL was pulled through almost to the floor below,

and it could be that it was used to climb back into the attic. The problem for the burglars was that both the front and back doors of the building require a key to open from the inside and out, so there was no way out except the way they got in – and they took nothing with them (nothing in there to steal, really, at least not that they could pull up and out through that attic.

We've made temporary repairs to the eave vent and repaired the ceiling damage. We have also upgraded the security system with motion sensors and motion-sensing cameras to improve our overall site security.

And we're still dealing with the main antenna issue at WDJC-FM. The new ERI SHP-8AC was delivered over a month ago and has been sitting in the storage building at the site ever since awaiting a tower crew to install it. We've had several commitment dates from the crew come and go, and I'm just about ready to pull the plug on that crew and find another one. Thankfully we have a good, full-power auxiliary antenna, so we're not exactly suffering as a result. Still, if something were to happen to that antenna or line, we'd be dead in the water.

Buffalo

On top of all that and speaking of tower crews, we still have the broken base insulator at WDCZ to deal with. I searched long and hard for a tower crew in the eastern U.S. that would be willing to do the swap for us, and I found a couple through Austin Insulator, crews they had worked with in the past. I had several back-and-forth communications with these tower contractors, sending them photos, drawings and talking with them by telephone. All of them eventually ghosted me and stopped responding. They apparently didn't have the courage to simply tell me that they couldn't help me. I have zero respect for such operators and I won't be reaching out to them again.

Thankfully, there are some tower contractors that I can absolutely count on, and one of those is Northstar Broadcast in Sacramento. Affiliated with Magnum Tower and P&R Tower, Northstar is the contractor that built the new KBRT towers for us, replaced a base insulator for us in Portland and replaced another for us in Denver. I knew that if I called Jason Kardokus at Northstar, he would be willing to take on the WDCZ job, and that's exactly what happened.

We finalized the design of the replacement insulator with Austin, and shipment is expected in late May. We will then have to wait for a hole in Northstar's schedule for a couple of their best guys to get on a plane for Buffalo. We'll have a crane do the lift, and hopefully replacing the insulator will be a quick, one-day job.

In the meantime, the remnants of the old insulator are holding up okay. We've been through several storms and one earthquake with no evidence of further cracking, thank God.

Some good news – our Buffalo/Rochester stations are now operating from their new digs in Amherst, NY! The guys from InRush Broadcast Services got in there on the 10th of last month and over the next couple of weeks got things moved over. There is still work to do, and InRush is, at this writing, back in there finishing up a few things to make it all perfect.

Beyond the studio move, we still have to complete the microwave system installation and commissioning. That project got sidelined by a number of things, mainly the base insulator issue at WDCZ tower #5. We discovered the insulator problem in January as we were preparing to install the 6 GHz microwave antenna on that tower for the link to the WDCX(FM) site in Boston, NY. With that insulator broken, nobody was going to climb that tower.

Knowing that we likely won't have the insulator replaced until sometime in the early summer, I modified the PCN (coordination) and filed the FCC application to move the microwave antenna to tower #2 in the WDCZ directional array. That application has been granted, and we're good to install on that tower now. Why tower #2 you ask? It's the second lowest power tower in the WDCZ/WHLD shared directional array; tower #5 has the lowest power, thus the reason for it being my initial choice.

Hopefully we'll get the microwave system up and running this month. That will wrap up the Buffalo studio move and put our connecting infrastructure back within our control. Until that happens, we're relying on the public internet for transport of program audio, remote control, etc. to our transmitter sites.

Brian is up to his neck right now in the WDCX studio move and microwave project, so he'll be taking this month off in these pages. Look for his column to return in the May issue.

Power Monitoring

I recently read a very helpful tech tip in the Alabama Broadcasters Association's (ABA) Monday Morning Coffee and Technical Notes. This note was a reminder of how AM antenna input power is calculated, and it was correct – the "direct method"

for AM power calculation uses the measured RF base or common point current and the antenna or common point resistance. Assuming the current is in amps and the resistance is in ohms, the familiar I^2R yields the power in watts.

The thing is, that is only one of the two methods permitted by the FCC rules for direct measurement of RF power for AM stations. §73.51(a)(1) says "The direct method consists of… using a suitable instrument for determining the antenna's input power directly from the RF voltage, RF current, and phase angle; or…" with the I^2R method listed in (2) as an alternative. Modern solid-state transmitters all include direct-reading wattmeters, which can be used under this rule to directly read the power. The advantages are numerous – no math required, and no need to run a wire through a high-RF field to get the base or common point current sample, no lightning following that sample wire back into your R/C system, etc.

The way this is written into the rules as "option 1," it would seem that this is expected to be the primary means of determining operating power. Most, if not all, AM licenses will show the licensed current for the individual modes, but they don't specify that an I^2R method be used. The rule permits either. We use both methods in our company, depending on location and circumstances. Diplexed operations often have stray other-frequency circulating currents that show up in the base current sample, so transmitter power meter indications are definitely used in those situations.

I mention all this here just in case it would be more convenient to monitor power, both locally at the site and remotely, using the "option 1" direct method. Seems to me that this is definitely the easiest way to do it.

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

Main Antenna Line Burnout

Both of WMUZ-FM's antennas were installed in 1985. Cris Alexander tells me their purchase and installation were among the first of his projects when he joined Crawford Broadcasting. Both the main and aux antennae are identical and rugged ERI four-bay ERI SHP-4AE "ROTOTILLERs". Both have operated flawlessly and provide excellent coverage from our 500-foot self-supporting tower located dead center to the population of the Detroit metro area. So, why am I discussing them?

Unfortunately, the main antenna system stopped working subsequent to a recent ice storm that necessitated a significant power reduction. During the storm I noted that the transmitter had dutifully folded back due to high VSWR. Not being satisfied with the remaining amount of reflected power, I reduced transmitter power further. This brought the amount of reflected power to a number I was comfortable with, and I planned to remain at that reduced power level until the antenna's ice coating melted away. As expected, a day or so later the weather warmed, and the ice disappeared; I returned to full power noting no unusual or appreciable level of reflected power.

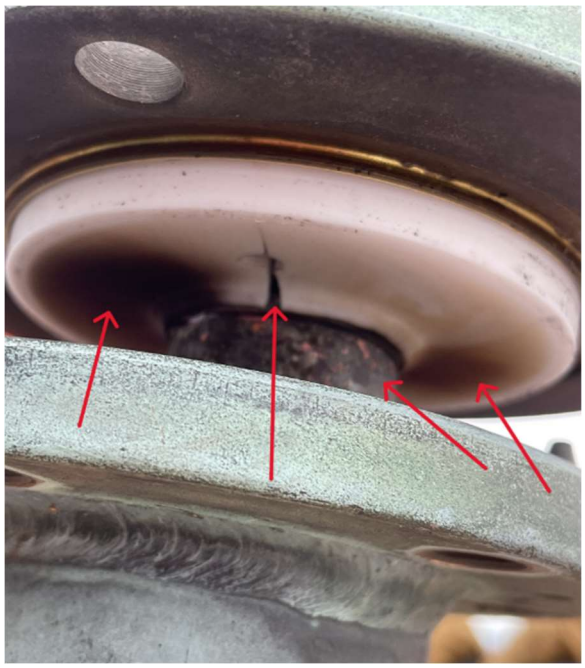
Within 48 hours of our return to full power, which requires a TPO of 26.7 kW, the transmitter shut down completely, issuing several alarms. I flipped on the aux and headed to the site.

When I arrived, I immediately tried to start the main transmitter again and could see that the problem hadn't magically cleared up. At that point I put the main transmitter on the aux antenna and tried the aux transmitter into the main antenna – no go. The aux transmitter didn't balk as quickly as the main did, but it did complain and eventually shut down with a VSWR OVLD lamp glowing on its front panel.

NV40 Status Display -- Not Good!

Troubleshooting the Antenna System

I was at this point nearly positive that it couldn't be anything else but an antenna or line issue causing the problem. The next thing to do was to fire up the drone and do some visual reconnaissance. Fortunately, Crawford has a really nice Phantom Pro4+ sUAS (drone), and I am an FAA licensed sUAS or Small Unmanned Aircraft Systems pilot. With my able assistant Steve Cuchetti acting as my spotter, up in the air we went.



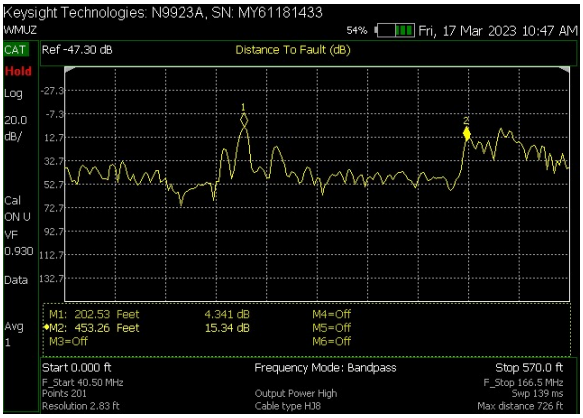
Just one of the places where the line arced.

With the drone's 4k gimbal-mounted camera, video and still photos are simultaneously possible. Flying as close to the tower as possible, the drone's proximity warning and collision avoidance system was continuously active and the remote control beeped incessantly. The unit refused to fly any closer than about eight feet from the tower, which gave us a fantastic view of the antenna bays, inter-bay lines, parasitic radiators, and the rigid 3-1/8" transmission line as we recorded from multiple angles. In places where I wished to see even more closely, I took photos which allowed me to zoom into areas of concern while I reviewed them after the flight.

I made four different flights looking for anything from burn marks to bullet holes. I've had line shot before by knuckleheads thinking that it'd be funny and shoot out a beacon. I looked for possible dents caused by falling ice and for signs of lightning damage. The line was holding pressure, so I was certain I wouldn't find a breach, but it'd have been nice to see some evidence of overheating due to bad connections or arcing.

The Inspection

Using the video and photographs, we made a plan to inspect the antenna system. I had also ordered an electrical inspection using the tower company's technician and his excellent new network analyzer. I had taken a quick look at it with our Time Domain Reflectometer (TDR) and could see a bit of a sag in the trace but with the crew's Keysight FieldFox N9923A, the issue became clear. Somewhere close to



TDR graph of the WMUZ-FM line. Note the mess around 200 feet.

the area of 200 feet from the measuring point in the transmitter room, the transmission line showed significant return loss, indicating something wrong.

Two crew members climbed to the spot, opened up the line and the issue was immediately evident. The bullet connectors were scorched, and the insulating nylon was darkened from overheating. A few more areas were inspected plus and minus 20' from this one and they both showed similar damage.

The Solution

While it is possible to repair rigid line, there is enough evidence to indicate that there are probably plenty more connection points with similar problems, meaning we'd have to disassemble and lower every 20-foot section to the ground and clean/refurbish each one. This would be a time and labor-intensive job, and at the end of the day we would still have a 38-year-old transmission line, making it more attractive to simply replace the line.

That decided, new RFS Heliflex line is on order, and to top it off (literally), a new ERI SHP-

4AE antenna will be arriving, complete the replacement of the whole main antenna system.

Fortunately, our aux antenna is working well as a stopgap and provides excellent coverage, too. You'll read about the replacement part of the project in a future *Local Oscillator* column.

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

Birmingham "Watergate 2023"

Friday March 17th, I was told that one of the toilets in the studio side of our building didn't flush properly. Jack Bonds and I visited every water outlet in the building and didn't notice any leaks in the system, but we also noticed no pressure in the system at all.

I immediately visited the Birmingham Water Works Board website to fill out their outage form. I needed an account number to complete the form fully, so I called our corporate office since we don't get the bill directly here in Birmingham. There was no record of the account in our system. Of course, that seemed strange, as we've had constant water supply since we moved into the building in 2006.

With that news, I went ahead and completed the web form without the account info and waited to hear from them about when they would be out to fix the issue. And I waited.

Saturday rolled around and I texted our board operators at the station – still no water pressure in the building. On Sunday, I stopped by the building and again checked everything in the building to see if I missed a leak or if the pressure had come back on. Nope on both accounts.

It may be different where you are, but BWWB doesn't exactly have a reputation for efficiency in the greater Birmingham area. When Monday rolled around and we still didn't have water in the building. I visited our next-door neighbor and asked if they were without water, basically looking for someone to commiserate with. He told me that they had had water all weekend. He also offered us his outside spigot in order to fill up 5-gallon buckets to begin to flush our toilets. We accepted his offer, and we got busy going around filling toilet tanks.

Then, I started directly calling and asking about the account and what was going on. Over the course of three calls, it was determined that we owed $9.47 on an account that had been shut off in October of 2020 (!!!).

So I pulled Cris in since the paperwork to establish a new account needed information that I didn't have. He submitted the paperwork in the online portal and I called a fourth time to make sure there wasn't anything else that was needed.

After explaining again what the situation to the fourth representative, she looked at (presumably) the same screen the others had looked at and told me, "Oh, I think I see what happened, do you have a Suite 108 in your building?"

As it turned out, right around that 2020 time frame in question, we had a new tenant take residence in our building. Their business is buying and flipping property for profit, and they are in in Suite 108. They deal with BWWB all the time to turn water on at their properties, and BWWB had made a mistake on one of their applications and put our address in as the site to be turned on. Of course, we already had an account, so their employee put our account on "hold." They obviously realized their error and corrected our tenants request, but they never took our account back off of that hold position.

So it took two years and three months, but BWWB, post-COVID, finally began to shut off delinquent accounts, even the $9.47 kind.

Folks, I'm not creative enough to make this story up. Thinking back on that time, I think the request for new water service also threw up a red flag to our local fire department, as we got a visit from the fire marshal a few months after October 2020. The marshal had even commented to me that his visit had to do with a new tenant, but he didn't get specific about the actual reason.

We have water turned back on at our studios, and Jack and I got the workouts we so

desperately needed hauling water in buckets all around the building from next door. God put a cherry on top of the story by allowing two snakes to be coiled up inside the manhole when BWWB came to put the meter back on our system, and we also don't have to make up for the water usage as it was clearly their fault that the any of this happened in the first place.

It can happen to anyone, anytime.

Be Prepared...

Later that same week, we had a collapse of our Nexgen system when we had a power outage at around 3 a.m. on Thursday morning. Every workstation went into local database mode.

Traveling to the studio and talking with the WDJC morning crew, I figured out the databases weren't talking. I got into our network via MeshCentral, and by the time I got to the station, I had connected all of our mission-critical machines so that their signals were back on air.

It became evident that the databases had rebooted, which should never happen unless someone in engineering is forcing it to happen. We have redundant power supplies in each one, UPS backup and a generator that takes about 15 seconds to be at full power.

What happened? It turned out, I was about to find out. I tested our generator which put us on its power, and immediately, two of our UPS units decided to take the plunge into the abyss together, and it happened to the two that were powering our primary and secondary database servers. Oh, and I left out the detail about our ClearOS internet firewall being on it as well. When I did the test on the generator, the ClearOS server's fans cranked into high gear and the file system told me that it didn't like being interrupted in that way. It hung up as well. All told, we were down for about four hours that included a complete rebuild of ClearOS and a restore of a backup we had on file.

We hadn't gotten any of the beeping notifications that the batteries were about to fail that are typical on those APC SUA-series UPSes. We had tested them about a week prior and all was well. The loads on any of our UPS units aren't anywhere near capacity. We had a spare tray, so we swapped out the worst one and are waiting on another set of batteries we ordered to make sure we're back to full capacity.

Things like this, after some introspection, always expose that you maybe aren't as prepared as you think you might be. In this round, we ended up spreading our power distribution out for the servers wider than just to the two UPS units. Now a third one is involved. It also exposed that I only had one ClearOS box to provide all of our internet. I'm going to be building out a second ClearOS box so that I can simply move ethernet cabling to the other box in the event that something catastrophic happens again. In that way, we might not have internet for five minutes versus 2.5 hours that we suffered through while I rebuilt ClearOS from scratch.

The entire week reinforced to me that in broadcast engineering, you have to be prepared for anything, and I mean anything that comes your way. We'll visit again next month, until then, blessings to all of you and your efforts.

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

Last time, I gave you a very brief introduction to networking as practiced in our facilities. I was sorely tempted to call this edition, "MAC the Knife," but that would just show my age. Instead, I'll continue with some things that I either didn't mention, or that will become important as we proceed.

The Route Command

You were introduced to this fellow last time. I blithely told you to look for the "default gateway" in the listing, but didn't tell you precisely how to get there or what all of the lines meant. In a Windows terminal with supervisor privileges, enter **route PRINT -4** to see your IPv4 route table (see Figure 1 -- remember, I'm sticking with IPv4 because that's what we use in our facilities).

```
C:\>route print -4
===========================================================================
Interface List
  5...08 97 98 83 f2 c4 ......Realtek PCIe GbE Family Controller
 10...c8 09 a8 49 9a d1 ......Microsoft Wi-Fi Direct Virtual Adapter #3
  6...ca 09 a8 49 9a d0 ......Microsoft Wi-Fi Direct Virtual Adapter #4
 16...c8 09 a8 49 9a d0 ......Intel(R) Dual Band Wireless-AC 7265
 11...c8 09 a8 49 9a d4 ......Bluetooth Device (Personal Area Network)
  1...........................Software Loopback Interface 1
===========================================================================

IPv4 Route Table
===========================================================================
Active Routes:
Network Destination        Netmask          Gateway
          0.0.0.0          0.0.0.0    192.168.1.1    Default Gateway
        127.0.0.0        255.0.0.0         On-link
        127.0.0.1  255.255.255.255         On-link
  127.255.255.255  255.255.255.255         On-link
      192.168.1.0    255.255.255.0         On-link    LAN (ARP country)
     192.168.1.82  255.255.255.255         On-link
    192.168.1.255  255.255.255.255         On-link    Broadcast Address
        224.0.0.0        240.0.0.0         On-link
        224.0.0.0        240.0.0.0         On-link
  255.255.255.255  255.255.255.255         On-link
  255.255.255.255  255.255.255.255         On-link
===========================================================================
Persistent Routes:
  None
```

Figure 1 - The route table from a typical Windows box.

Windows displays a list of all interfaces at the top and all routing at the bottom. For each line:

- Left: the IP address(es) that will be routed
- Middle: netmask for the IP address on the left
- Right: the route, where the data will be sent.

I've circled the lines that are of interest to us. These are not necessarily applied in the order shown. The default route (192.168.1.1) is defined first; "0.0.0.0" means, "any IP address." If there was nothing else in the routing table, everything would go to this IP address.

Next are some weird-looking "127" IP addresses. 127.0.0.1 is the most important; it's masked with 255.255.255.255 (which means "one single IP address") and is called the "Localhost." Your computer uses this special, internal IP address to allow different programs to talk to one another. Think about it: not only does your network have computers all over the place, lying to one another, *your computer lies to itself!* It's a beautiful thing.

When you sit down at a given computer, "localhost" is *that device* only. Not to belabor the point, but at the moment, "localhost" is the computer where I'm typing this. If I move to one of my other PCs, "localhost" refers to *that* device. Figure 2 is from my computer, which has a Web server installed for testing. I use localhost to work on the POR system on my local computer; once I'm happy with the changes, I can upload them to our Corporate Web server.

Next, you'll see "192.168.1.0," which is the base LAN address. The netmask (255.255.255.0) is for a standard Class C Local Area Network, which, given a base of 192.168.1, means "everything from 192.168.1.1 to .255." This is Address Resolution Protocol (ARP) country, which I discussed last time.

192.168.1.82 is the IP address of my Windows computer. The next one, 192.168.1.255 (with the "one specific IP address" mask of 255.255.255.255) is the broadcast address. As also mentioned previously, this is indeed the highest possible IP address on this particular LAN. That's always the case on any given LAN, whether it's a small "group of 8" addresses from your ISP or a big system with thousands of computers.

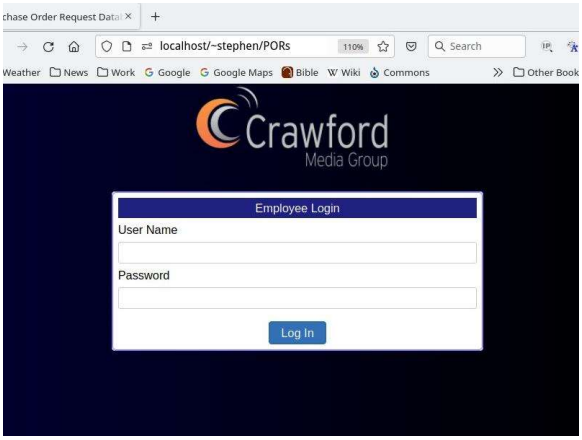


Figure 2 - Accessing the localhost on my computer.

As for the route listing itself, I can get the same information in Linux, MacOS or any other modern, network-capable operating system. Linux requires the use of separate commands to collect all of this info, but it's far more detailed and descriptive. Windows doesn't tell you a lot about each of these (the "On-Link" thing isn't very useful), but again, I've circled what you should care about.

MAC, No Cheese (Hopefully)

This stands for "Media Access Control" and it identifies a specific and unique Ethernet interface. It can also be called the "Ethernet Address" or "Physical Address," but go back and read my disclaimer about keeping things simple in the previous issue. Most of the time, you won't care about this weird-looking number, but it can be useful in a few specific circumstances. Note that Windows' **route** command listed the interfaces at the top of Figure 1.

Like IPv4 addresses, the MAC is composed of octets that can hold a value from 0 to 255, but written as six base 16 ("Hexadecimal," or just "hex") digits, separated by dots or dashes. The first three octets are the vendor/manufacturer's specific code, assigned by the IEEE. The remaining three octets can be considered a serial number, unique to that specific interface.

Just as no two hosts on a LAN can have the same IP address, you can't have duplicate MAC addresses, either. Given that it's supposedly hard-coded into the interface, is this even possible? Yes. Many routers will allow you to "clone" (i.e., copy or imitate) a MAC address. But even with hardware-coded MACs, it can happen; in fact, we once had two different uBiquity links with the same MAC address. That one was *fun* to run down.

The symptoms will be similar to duplicate IP addresses -- the network may come and go at random, or you'll have a device that you *know* is connected, but it just won't answer. I showed you last time how to flush and read MAC addresses with the "arp" command; you'll have to disconnect computers, then flush, reconnect, then ping, then check the MACs. Rinse and repeat, then wipe your hands on your shirt. It's a pain in the neck, and thankfully, this is really rare – truthfully, it should never happen, but like I said ... it did to us, at least once.

A few other points. First, if you want to block a specific host from Internet access with your firewall, it's better to do it with the MAC address rather than with an IP address. The latter can change; by definition, the MAC is supposed to be static and unchangeable.

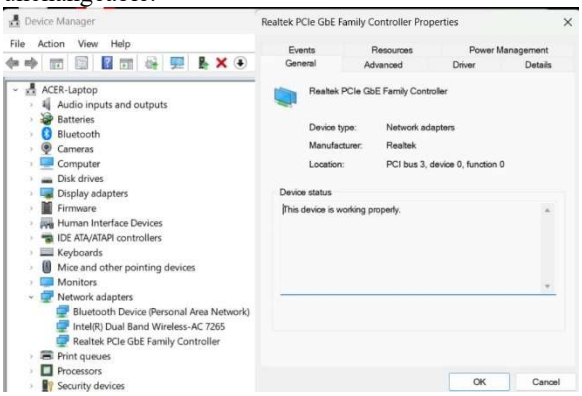


Figure 3 - Getting info about a specific network interface.

Second, if you're on a different/older OS, you can find the name of the network interface's vendor from those first three digits. Google "MAC address lookup" to find a bunch of different sites that will do this for you. You will discover some interesting things, not the least of which is that the manufacturer who built the interface may not have the same name as the one on the unit.

In the past, I would have told you that you could use this info to help troubleshoot; if nothing else, you could quickly determine who manufactured a given network card. Nowadays, everyone buys from everybody else and just stamps their name on it. Besides, an easier way to do it in Windows is with the route command, as shown previously, or with the Windows Key and "X." Choose "Device Manager," then click "Network Adapters." Select the interface you want to examine and some info will pop up (Figure 3).

Layers, We Gots 'Em

Most references on networking are quite arcane (a polite way of saying, "needlessly complex for what we're doing"). I told you last time that virtually everything in our facilities is Ethernet compatible. Put even more simply, the IP stuff rides on top of the MAC stuff. We can split this into three "layers:"

- The application/Internet stuff, IP addresses, etc.
- Ethernet, MAC addresses
- The physical/electrical transport method

Up top are the Internet protocols -- TCP/IP ("Transmission Control Protocol over Internet Protocol"), UDP ("Universal Datagram Protocol"), and so on. The data is wrapped with headers that contain source, destination, port numbers, the size of the packet, and so on. This is where IP addresses live and play, and it's where you'll tinker most of the time.

Under this is what you can call the "MAC" layer: Ethernet-to-Ethernet. Below the MAC stuff (again, from our ultra-simplified point of view) is the actual physical transport method: this can be wireless, CAT5/6 cable, fiber -- anything that can ferry serial data. You have to keep all three in mind when troubleshooting. Start at the top (the IP stuff), then work down from there. When installing, you'd typically start at the bottom (physical installation) and work *up*.

Just to keep the Geeks from calling in an air strike, I'll invite you to use Google or Wikipedia to delve into this more deeply. You might start with the 7-layer OSI Model, but you have been warned: different Governing Geeks use different models to describe these layers. Better yet, there's overlap; what one model calls the "transport" layer may be something entirely different in another reference, or split into 2 or 3 separate layers in a third reference.

Finally

A bit off-topic, but important. My buddy Todd Dixon has written about this in the past; I thought I'd reiterate it from a programmer and developer's point of view. Remember that most of the "smart" devices that we use in broadcasting don't have a lot of storage space, RAM or processor power. In many cases, the manufacturer is using an off-the-shelf module to do what they want.

Nothing wrong with that, of course. But keep in mind that these devices have very limited resources and as the unit ages, they can easily become clogged with old data and software. From time to time, check for updates, too. In many cases, you can make a world of difference with a full power-off, back-on reboot. That will clear the memory.

You should also back up each of these devices wherever possible. Contact the manufacturer if they don't include instructions with the unit. If they balk, use sweet reason. In a previous issue, Todd related how the solid-state drive in one of our Nautel transmitters had died; he had a time getting that back up. You may have to get creative; for example, pull the SD card from your Raspberry Pi and copy everything to a different card. Clearly mark the backup (unit name, date, time) and store it in a safe place.

Until next time, keep praying for this nation!

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

The Calm before the Storm

At our Burnham, Illinois (WPWX) transmitter site, we are in preparation for two big projects. One, a generator project, is a holdover from 2022 due to supply chain issues. The other, a new GV30 transmitter for WPWX, was planned for this year. So, the perfect storm would be for these two big items to arrive at the same time.

While I am being told the ship date for the generator that was supposed to arrive in April of last year, is now "any day now," the new Nautel GV30 transmitter is due in May. My guess is that they will arrive on the same day. I can already envision myself holding one truck back as the other one delivers its load.

Not likely to happen, but three years ago, who would have thought it would take nearly 18 months to get a generator ordered and delivered.

While we await deliveries of these two big items, we are trying get as much as prepared as we can. The interesting part for me is that I am still having issues finding an electrical contractor to do the work on the generator installation. Again, post COVID, most companies still are fighting to keep enough staff to have more than one crew out at a time.

My nature is to fret over these types of uncontrollable situations. I am learning and re-learning to lean into God and trust Him in all these circumstances. I tell myself, this will all eventually get done, just not on the timetable I am used to having.

Bullet M Ethernet Link

We have a 5.8 GHz Ethernet link between our Lansing and Beecher, Illinois towers, an 18 mile shot. It has been down for a while, as the cable on the Beecher tower was not usable as it was full of water. We needed to put up new cable, and I wanted to make sure we used the direct burial CAT6 that is water resistant and has the thick copper shielding to protect from large static discharges.

Due to supply chain issues (again!), it took almost a year for that cable to be delivered, so, in February, we were blessed to have a really nice day of weather and the tower crew was ready to go. They pulled the new cable up and attached it to the Bullet M Ethernet radio. I wasn't sure if the radio was still operational or if it would be on default settings. However, I couldn't get in touch with the radio on either the normal IP address or the factory default IP address.

At that point, we sent up a replacement radio with the correct IP address. I expected it to work upon connection, but it wasn't showing up, either. I kept the tower crew on hand until it was almost dark as we retested every cable on the run. Everything tested well. I had to send the tower crew on its way.

A few days later I went through everything, and when I changed out a connector at the bottom of the run, I got the login page of the radio, but it again disappeared when I tried to login. At that point, because the radio is 300 feet up the tower, it was probably at the limit of its workable distance, and the working theory was that we may have too much voltage drop using the normal POE that came with the radio.

We purchased a much stronger 48 VDC power supply, and I built a POE injector to connect it to the radio. Once again, when the initial power was applied, I was able to connect to the radio long enough to bring up the login page, but when trying to log in, the link to the radio disappeared and never came back, even after a couple of reboots.

There are two theories: one, the new cable is bad, or two, we have a flaky radio. I have another radio ready to jump in if needed, and I have purchased a different type of cable to have on hand. So, we await another time to schedule the tower crew to come back and try swap and replace diagnosing the issue. Hope I have good news on this by next month's article.

Rocky Mountain Ramblings
The Denver Report
by
Amanda Hopp, CBRE
Chief Engineer, CBC - Denver

First Quarter Ends

Are we already through the first quarter of 2023? In many ways, the time has dragged on. But in many other ways it has flown by. How is it even possible for time to drag on and to fly by all at the same time?

Is That a Wounded Animal?

On a trip up to our studio roof to look at something, what that something was I don't remember, but as soon as we got on the roof we could hear an awful noise, it honestly sounded like an animal was being killed.

I went and investigated and found it was our AC unit. The belt was cracked and slipping. I went back to my office and found the belt at Grainger and immediately ordered it. We were able to pick it up the next day and install it. I also used that opportunity to change out the filters. Sometime in the next month, I will take our little power washer along with some water up to the roof and spray the condenser coils and economizer filters.

HD Issues

March was a month of HD issues, and still continues to be. First was KLVZ-Day. I had a report from an employee that the HD was not working. Upon investigation remotely, I determined the AM-IBOC Exciter was not functioning properly. Thankfully it did not crater and kept the station on the air. A reboot did not fix the issue, so I took it out of the rack, switched the station to analog, and brought the exciter back to the studios where we could easily bench it. I went through and did an update to the unit. It came back up properly, so I took it back out to the site to get things back in HD. Thankfully, this fix has been solid.

KLTT is the other station that has been having HD issues. During one of my random checks of the stations on air, I found the diversity delay was off. In talk radio, that can mean a word or two, or even three, is missing. I won't say I check the station every day, because I don't (shame on me). So I have no clue how long this has been going on.

I went to the site, found nothing out of the ordinary, so I rebooted the exporter. This brought things back to where they were supposed to be. However, within hours, I noticed the delay was off again. I contacted Nautel support who had me look at several things. Unfortunately, no smoking bullet was found. My next step is to recalibrate the exgine VCXO. I hope to do that soon.

Tower Lights

My husband works up in northern Colorado on a daily basis. His trip up north in the mornings takes him right by the KLTT tower site, which is just south of I-76. He always looks and lets me know of any issues he may see.

On one of his trips by the site, he noticed that tower four looked dimmer on the lower beacon. I was able to somewhat check with our security camera and was nearly certain we had a bulb out. That night, I drove out and did determine with a pair of binoculars that the bulb was indeed out. We hired a tower crew, who came out the next week and replaced all four beacon bulbs on the tower.

This was the first time we've had to do tower work for lights in a couple years. It used to be a yearly thing, so perhaps the batch of bulbs we were previously using wasn't that great. Hopefully this will be the last of the bulb issues for another long while.

When Failovers Fail Us

At our four AM sites, we have Barix Exstreamer 1000 units as backup being fed by the local internet we have at the site. The Omnia 9 processors are set to failover when the main digital feed (from the microwave) fails. This is great. It has been a game changer, making it so that I and others don't necessarily have to babysit the station when

bad weather rolls in. We can all rest a little better knowing that if rain-fade happens or even just a glitch in the main link (which typically happens at KLTT), the station will remain on air.

On the 18th of last month, I received reports of the studio internet being down. Saturdays are very busy for us during the morning and early afternoon hours, so I immediately called Comcast to report the outage. I was informed that they were doing maintenance and it would be back within the hour.

During all this, I received a report that KLVZ was off air. My thinking was that the internet at the site was down and for some reason it was stuck on that analog feed. I drove into the office where I could get on the local network and investigate a bit more. I found that the Barix side and the main side both didn't work. The internet didn't work because we had no internet at the office to send that feed out. I began looking at all the equipment and quickly found the BridgeIT Xtra codec was unresponsive.

I ran the station on the night site for a little bit until the internet came back up, and once it did, the Barix had audio. I left it on the Barix until Monday, when a simple reboot of the Xtra brought things back.

I'm not completely sure what happened. All I can assume is that with the high winds we had on that Saturday, maybe we had a power glitch. The Xtra is on a UPS, but as we all know, those quick power bumps can still cause issues.

I am now working to learn SNMP. We have two nice Nautel transmitters with SNMP, the Omnia 9s have SNMP, and even the Tieline Gateways have SNMP. So far I've gotten one of the Omnias to work with one of our two ArcPlus Touch units to show the input status and have the ArcPlus notify me of a failover.

In the case of the KLVZ codec failure, there's no telling how long that unit had been down. The backup feed would take over seamlessly and I wouldn't know there was an issue unless I was looking for it. We were at the site a week prior and all was working. Had I known about this failover when it occurred, I could have easily figured out the issue and not had any down time when the studio internet went out.

KLDC Issues

KLDC has also had some weird issues. Well, one weird issue that we know about. We aren't sure if it's one thing or two.

On the 21st of last month, I was looking at our Burk AutoPilot program and saw that KLDC was not connecting. With some of the recent updates to the program, I have noticed that this will sometimes happen and a simple restart of the program fixes the issue. So that is just what I did. When it came up, it still would not connect. We could see the Cambium microwave link both on the studio and transmitter site ends but nothing inside the transmitter building. This pointed us to a network switch issue. I drove to the site and went in the building. To be honest, it was the end of the work day and I didn't take the time to really look things over. I noticed the ArcPlus was not seeing the IP-8. I went ahead and just did a network switch power cycle and soon after, everything came back.

A couple of days later, I noticed the same symptom: KLDC was not connecting to AutoPilot. I logged into the microwave at the site and noticed it said no network connection. This made me think it was not a network switch issue. The Cambium would come before the network switch. On a whim, I hit the reboot button on the screen and let the unit reboot. When it came back, we had network again.

So the real question is, was this two separate issues, or just one weird one? So far things have been working smoothly and all I can do is monitor them. To say it's been a weird month for three of our five sites is a bit of an understatement, but as of me writing this, all seems right in the world again.

Coming Up

I cannot believe April is already here. I am very excited as that means BASEBALL! Technically the season started on March 30, but April is really when it's here. My parents, husband and I will be going to the Colorado Rockies home opener on April 6. The last time we bought opening day tickets was in 2020, and a few weeks before the season was to begin, MLB made the decision to postpone the season. And, if I am being completely honest and can be blunt here, the Rockies *suck*. They are not a good team by any means. The owners don't ever want to spend money on getting good players, and they don't have to – they pack the ballpark with opposing team fans just about every game (most people who live in Colorado are from somewhere else). For all intents and purposes, it's a farm system which is great for the player looking to make a next step. It would be nice to see the owners go after some big names in free agency in hopes of getting us to that elusive World Series. Or at least the playoffs.

I have no doubt that weed growth will start being seen at some of our sites soon. Due to some issues out of his control, Seth Peterson hasn't been able to do much work for us and we just aren't sure when/if he will be able to do anything this year to

help. Until we can determine that, I will be picking up the slack. I look forward to having an excuse to be out of the office. I have plenty of work to do at the transmitter sites. Work that due to busyness with other projects and issues I have neglected for years. I also look forward to getting each site back in great shape.

That about covers it for this edition. I hope your baseball teams play horribly and the Rockies win every game (fat chance!). I pray you all stay safe and well!

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

Crawford

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