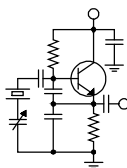


# The Local Oscillator



## *The Newsletter of Crawford Broadcasting Company Corporate Engineering*

---

MARCH 2023 • VOLUME 33 • ISSUE 3 • W.C. ALEXANDER, CPBE, AMD, DRB EDITOR

---

I've heard it said that God created time so that everything doesn't happen at once. There's a certain humorous logic to that, but at times it feels like it's not working because everything does seem to be happening at the same time!

Right now, we've got the big studio buildout and move project underway in Buffalo. The integration crew from InRush Broadcast Services is there right now, and they should have things wrapped up by the 10<sup>th</sup> of the month.

The microwave network installation continues as weather permits. That continues to be a challenge. The good news is that the FCC has granted the application for the height change at the WDCX-FM (Boston) site, so we're good to use the system as soon as it's installed and pathed. We do have the rooftop installation at the studio done, and the antennas are up on the tower at the relay site and at the Boston site. We have a good power and fiber connection at the studio but still have to get that going at the SUNY relay site and Boston and then do the path alignment.

In the meantime, we're running on internet STLs using TieLine codecs at all three sites, and so far, so good with that. We have Viasat satellite internet backups in place at both Buffalo transmitter sites that we'll do away with once we get things up and running on the microwave links.

While all that is going on, we're still trying to get a tower crew to come deal with the broken base insulator on tower #5 at the WDCZ site. We have a "dummy" steel insulator on hand ready to go in to

support the tower while we await fabrication of a new real insulator, but so far we haven't nailed down a crew to come jack the tower and swap it out. We're talking to several crews and hope to get one to commit to the project shortly. Of course we can't complete the microwave link to the WDCZ site until

the insulator is fixed, so we may be on the internet STL for a good while there.

At some point soon we've got to get the C-band antenna along with the STL tower and dishes off the roof of the old building. You might recall that the roof membrane blew off during a big storm a few months ago. Temporary repairs of some sort were made, but the roof is leaking into the space below and the landlord is on

us to get our stuff off the roof. We'll take care of that as soon as we get the buildout and move done.

And then there is the WDJC-FM antenna issue. At this writing the antenna is on site at Red Mountain in Birmingham and ready to install. At this point we're just waiting for a slot in the schedule of the tower crew to get it hoisted into place and assembled. A TDR sweep showed a clean transmission line without any impedance bumps or discontinuities, so once the antenna is up and the line is connected, we should be back in business. We'll have to schedule an ERI tech in to do the field tuning at some point, but the antenna should be good enough to use out of the crate. I hope.

And then there's the WMUZ-FM antenna issue. The Midwest saw a big ice storm in mid-February that gave us grief on all our FMs in the region, especially in Chicago and Detroit. All rode



**The Santa Ana Mountains of Orange County, California. This photo was taken by Mike Duffy on Feb. 25. The KBRT Oak Flat transmitter site is up there somewhere.**

the storm out okay, folding back transmitter power to keep reflected power at a safe level, but when it was all over, there was clearly something wrong with the WMUZ main antenna, an ERI SHPX-4AE. At this point we don't know what the issue is (and it could still be ice – a drone flight showed some ice on the antenna), but we'll get a tower crew up to look at it shortly if we need to. In the meantime, the station is running on the identical aux antenna at full power.

### Climate Change

I've heard all the arguments, or a lot of them anyway, on both sides of the "global warming" issue. A decade ago, it's all we were hearing about. With pols like Al Gore and a host of celebrities telling us that the sky is falling, the global warming issue became a religion of sorts for many.

In the years since the crest of that hysterical wave, the rhetoric has morphed to "climate change." That's something I can agree with. Based on what I know of the earth's history, the biblical record and what I've seen in my own sixty-several trips around the sun, I can agree that the climate is indeed changing, and it has been in a more-or-less constant state of change since the beginning of time. Weather is not a static thing. Different regions have hot and cold years, wet and dry years, and we see things changing in response to climatic variations on a global scale.

Personally, I think it's the height of hubris for man to believe that anything that he can do will have any significant effect on the climate of this planet or any region therein, barring some kind of "nuclear winter" resulting from the unthinkable. Should we be good stewards of our planet? Absolutely. But how far should we go in reducing carbon emissions and the like? I think there's a middle ground in there somewhere.

Last year in Colorado, we saw lengthy periods of record cold. At our church, we had interior heating pipes burst on several occasions when we had -20 degree nights. This year has been warmer, with shorter cold periods and lows in the negative teens (it was -11 on my car temp display as I drove to work one morning late last month), but we've had a lot more snow. You can't even see our house from the county road because the berm from the snowplows is 15 feet high!

This year has been a real outlier in Southern California. There was a little snow in the Hollywood Hills last month, and on a couple of days in February we had snow at the KBRT Oak Flat transmitter site. The photo on page 1 pretty much says it all. Our pond at the site is full from all the rainfall we've

received this season. I don't think that pond has had any water in it since 2014 or so.

Snow in Southern California, ice storms in the Midwest, huge snows in Colorado and Buffalo... it's been different this year. My guess is that we'll



**A security camera array at the KBRT Oak Flat site caught this snowy scene on February 25.**

continue to see these kinds of changes as time goes on and the climate continues to change.

### Remote ID

Last fall, the FAA implemented "Remote ID" rules for small unmanned aerial systems (sUAS, or "drones" in everyday parlance). There was a lot of pushback from both drone manufacturers and users,



**The Dronetag Mini is affixed to the rear of the camera gimbal on our Phantom 4 Pro+, the only flat surface on the airframe.**

but the FAA and EU aviation authorities pressed forward with a new set of rules requiring drones to broadcast their position, altitude, speed, takeoff

location and elevation, and a time stamp via WiFi, Bluetooth and cellular.

The effective date for drone manufacturers to equip new products with Remote ID was September 16 of last year. The effective date for all drones except those flying in special FAA-Recognized Identification Areas (FRIAs) is September 16 of this year. That means that by September 16 of this year, we will have to either upgrade our fleet of drones to new, Remote ID equipped/compliant units or purchase and install outboard Remote ID modules.

I started looking for add-on module options the middle of last year but didn't until recently find anything. One such module has popped up on the drone aftermarket, the Dronetag Mini, manufactured by a company in the Czech Republic. It's a little pricey at \$300US, but that's a lot less than more than \$1,300 for a new Remote ID equipped aircraft.

We purchased one of the Dronetag Mini modules last month and I was able to get it programmed and mounted to our Phantom 4 Pro+ drone. We did a short test flight with it and learned a thing or three. One was that I did not have the LTE set up properly – it came with European defaults that had to be changed for the US.

I also learned that the auto flight start option detects the “altitude” of both my 12<sup>th</sup> floor office and the roof of the parking structure behind our office building and assumes the drone is already in flight. It begins broadcasting position data before it has completely resolved its correct location. I turned off that option and now have to remember to push the button on the module before launching to tell it that the flight is starting.

Another thing I learned is that having the module on the back of the camera gimbal does not affect the gimbal's operation at all. The weight of the module is just over one ounce, so that's not all that surprising, but it was one of the things I needed to test. Why mount it on the back of the gimbal, you ask? Because it's the only flat surface on the aircraft!

I'll be watching over the coming months to see what else comes on the market. Hopefully we'll find some other choices, not necessarily because they will be better than the Dronetag Mini but because the competition will drive prices down. I won't, however, wait so long as to be on the tail end of the order queue as the 9/16 deadline approaches. Stay tuned...

---

### The New York Minutes

By

**Brian Cunningham, CBRE**  
**Chief Engineer, CBC – Western New York**

Hello to all from Western New York! March is here, which means that the WDCX studio move will quickly kick into high gear! Shaun Dolan and Coleman Connolly from Inrush Broadcast Services are on site as of Wednesday the first to get our facilities move underway.

I have been busy tending to much of the “grunt” work before their arrival in order to help speed up the project, such as cutting out wiring passageways in the studio furniture, installing rack rail, pulling network cables, and even cutting out the cabinet tops to accept the Wheatstone consoles. This type of work takes up a lot of time, and the more I can get done ahead of time, the quicker we can get this move accomplished.



Looking back over my broadcast career, I have been involved in hundreds of studio builds and over two dozen transmitter builds, most all when I was with S & B

Communications. One thing I have noticed of late is that I'm not as flexible and agile as I once was, and although my mind thinks I can still do what I did 30 years ago, my body reminds me daily that I cannot perform as I used to.

In all, I know that when the smoke clears and the dust settles, we will have a facility to be proud of! Even being able to access virtually any segment of our facility remotely is a great improvement, and to finally be able to broadcast a totally digital signal is truly a blessing. I can't wait to share pictures of our new and improved facility!

We did receive an unexpected gift on February 23rd, as Cris notified us that Canada responded quickly to our Part 101 microwave modification application, and we are good to go with our Cambium link!

You may recall in last month's column that we had to amend our Part 101 application, as the antenna height on the WDCX-FM tower was incorrect. Based on the original application, we were expecting the modified application to drag on into June before it received the go-ahead from the CRTC (Canadian equivalent to our FCC), so we were thinking of ways to stay on the air without using our old 950 MHz equipment.



**Test fitting the dummy insulator we had made to temporarily support the tower while we await manufacture of the real replacement.**

Communications has dialed in the path from our North Forrest studios to the state owned WBFO

We are currently sending audio to both WDCX-FM and WDCZ 970 via TieLine Bridge-IT XTRA codecs, and it is performing well above expectations!

I still have some work to do to get the Cambium system up and running. TransWave

tower (SUNY), and the link from the SUNY tower to the WDCX-FM transmitter in Boston, NY.

The final leg of this path will feed simulcast audio to the WDCZ transmitter site in Hamburg, NY, but this work cannot be completed until we secure tower #5's broken base insulator.

At the SUNY site, I have yet to install the wall-mounted Middle Atlantic rack which will house the power supply, surge suppressor and network switch for the fiber-optic feed to/from the dishes. We will get that done shortly.

At the WDCX-FM end, the radios have been tested and the weatherproof enclosure that houses the -48 VDC power supply has been mounted to the tower. All that is left for me to do there is to run 120 VAC from the building to the tower to power the radios, but the weather doesn't want to cooperate with us! Hopefully, we will have a break in the weather soon so I can get this final piece of the puzzle done.

As far as replacing the broken insulator on tower #5 at WDCZ, we have received the dummy (steel) insulator and are awaiting quotes from several crane companies to lift the tower just enough to remove the damaged insulator and slide in the manufactured "dummy" to secure the tower until the new insulator can be manufactured.

Cris found a company up in Mississauga, Ontario Canada that can manufacture an exact replacement, which they determined would take approximately 12 weeks. The good news is that they are located only a short drive from Buffalo, so we should be able to pick it up at Austin Transformer's shop and bring it back to Buffalo, saving us tons of shipping costs!

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**

---

### **Consolidating STLs**

I was excited to see a brand new Tieline Gateway 8 show up in our lobby a few weeks ago. When I started at Crawford in 2020, I was presented with an array of Tieline products. I had come from what you might call a 'Comrex shop' and was always happy with their products and only simply knew of Tieline.

I had a lot to learn about codecs once again, so I started off by exploring the Tieline's web GUIs and front panels a bit, but I didn't do any deep dives. Not until I was presented with a project that would call for distributing a program that originated in Texas and needed to get to a pair of client stations.

I had seen an unused piece of gear in Detroit TOC called the Tieline Genie Distribution and, lightbulb moment, I'll bet this is the perfect solution for this. And so it was. I was quickly able to configure the unit and create the connections and schedules needed to get the program where it needed to go every night.

It's been in use for a couple of years now, and apart from a couple of my own minor mistakes dealing with time zones crossing the midnight hour, it's worked beautifully. It also connects directly to our WheatNet network and I must say, any device that does that is a darling!

The more experience I had with Tieline, the more I came to like their gear. We have Tieline CODECs in service as STLs (Studio Transmitter Links) for several radio stations. Some are Bridge-IT, some are Bridge-IT XTRA, and our new Gateway 8 has just taken over duties for four discrete STL paths. We even have a Tieline Via for remote broadcasts, which is cool enough for a whole other article and a device I am a fan of.

So, what's with the Gateway 8 you say? Well, Tieline has had Gateway on the market for about four years so it's not exactly new. That said, it's still a very relevant device. It can be had in a 4-channel, 8-channel and 16-channel configurations and if you buy the 8-channel, you can buy licenses for channels as needed up to and including the 16th.



I have the 8-channel version and am using all eight to create four stereo STLs. While the Gateway will speak AES67, SMPTE ST 2110-30, ST 2022-7, Livewire+, RAVENNA, Dante, NMOS, Ember+ and WheatNet-IP AoIP, the WheatNet-IP was the option suited for our installation. WheatNet and Dante require the addition of an internal card to enable unless one elects to interface by way of WheatNet or Dante using AES67.

WheatNet-IP integration is as you might expect. Each channel both in and out are represented in the WheatNet Navigator system just as if the unit itself was a Wheatstone Blade. I haven't implemented any LIO controls, but they're supported in WheatNet, too, and I imagine it wouldn't be difficult to create or distribute contact closures to/from the far-end CODEC from wherever they live or are needed within your WheatNet system.

Gateway comes with countless different ways to connect to allow you to optimize your sound quality vs. bitrate balance. I prefer the encoding options that allow for FEC (forward error correction), since I use satellite internet services for some of my backup paths.



### **Tieline Genie Distribution (the "Disto") and Gateway-8 codecs. Amazing devices!**

I also take advantage of its ability to direct streams over specific WAN or LAN connections. I've configured backup STL connections to dial into the unit so that they can use dual-WAN routers on the far end. In this way if one ISP fails, the dual WAN router directs all data to use the remaining ISP. The

far end Tieline redials and the connection is made using the remaining available path.

There is far too much information about the Gateway to share within the scope of this column. It's a powerful tool you can use for multiple purposes at one time. It has an epic high-res LED front panel display and an easy menu structure, and, of course, it has an HTML5 GUI. Around back you'll find dual power supplies, two gigabit ethernet ports, StudioHub compatible I/O, a pair RJ45 jacks for AoIP, two more for LAN/WAN connections and two D connectors for GPIO connection. The unit can be used with Tieline's Tie Link traversal server, can be managed with their cloud CODEC controller, and supports both Smart Stream and Fuse IP.

I found a small bug in the SNMP implementation, but Tieline has promised to iron that out and once they do, I'll be monitoring its status via SNMP.

### Icy Disasters

The afternoon of the last Wednesday in February found me out in the cold rain at the WRDT night transmitter site wondering why my truck wouldn't start. No, the battery wasn't dead. It turned out to be a bad starter motor. Fortunately, out of pure frustration I tried the key just one last time and away she went.

FF>> to Saturday. With much of the Detroit area still in the dark due to the recent ice storm, I counted myself fortunate that I had electricity at my house and at every Crawford location under my charge save for one, which has an intrepid Cummins generator with a full tank of red #2 diesel.

Upon my awakening, my wife said, omitting any morning's greeting, "Why's it so cold in here?" Grabbing a coffee, I headed down to the basement. After reviving the furnace, I bounced out to the garage to fix my truck.

Before I could get started, Anthony, our Ops Manager, texts me: "What's up Mike? Silence on the FM," and I start seeing alarms re: same. A quick look and I can clearly tell that the main antenna was the issue, but no idea why. More ice, I thought? I switched to the aux.

With the FM back on air, it was back to the garage to remove what's now an intermittent starter assembly. I grabbed it and my wife's Jeep and headed to AutoZone, preparing myself mentally to

drop an obscene amount of money for a rebuilt replacement when our Ops Manager calls. "Now I'm getting an alert for WMUZ-AM 1200..." Okay – U-turn, head back home, open laptop, proceed to restore nothing. Conclude that a network switch had failed.

Upon arrival at the 1200 transmitter site which should have been running on generator, I'm



**The WMUZ main and aux antennas (on tower at right). Both are ERI SHPX-4AE.**

greeted with darkness and silence that said everything I needed to know – the generator had stalled, but why? I'd ordered fuel for Monday delivery and sure enough, there was just south of half tank left.

On the control panel I see "Shutdown : Coolant Level Low." Sure enough, I could see that there was coolant all over the radiator – the *outside* of the radiator. Nothing I can do; we're going to be off the air until the utility power is restored (which came roughly 30 hours later).

I headed north to Detroit to get a read on the antenna problem. The first thing I did was run the main transmitter into the dummy load to confirm it wasn't to blame – it wasn't.

As I write this, there is an undiagnosed issue with the main antenna. A quick drone flight still showed ice on the antenna, so that could be it. If the problem doesn't clear with warmer temperatures, I'm expecting to sweep the line and, as soon as weather permits, fly the drone to perhaps see if there is any evidence of a burnout or ice damage. I'll let you all know next month what happened and how we fix it!

Oh, and yes, I finally managed to get my truck fixed.

---

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

---

### **Red Mountain Starts to Cool Off**

One of the things in the budget for last year was a pair of air conditioning units for our Red Mountain tower site. Of course, the Bard units on the concrete prefab building had served us well with normal repair and maintenance since we had put the building on its foundation in 2007. The shock to the system was that new units had a lead time of nearly 26 weeks, putting us into February of this year.

Sixteen years is a long time, and a lot has changed since we initially set the building. The City of Birmingham had put a building on the lot next to us and placed their digital 911 equipment in it. Along with the seven antennas needed for their city radio communications service, an ice bridge from their building to our tower has been constructed as well, which is situated about nine feet off the back of our building. Oh, and they have a propane generator to keep their equipment running, with their fuel tank being placed at nearly midpoint between our two buildings.



**Figure 1 - The first of many tight squeezes.**

After an hour and a half of measurements, answering questions about what could and could not be

rearranged, we all walked away with some homework.

The simple part of the installation was going to be unhooking the old units from power and getting them off the wall. We knew we'd have to roll some fencing back, but the tricky part was always going to be moving the new units to the rear of the building.

The day of the install arrived, and Randall showed up with his excavator that was about 80 inches wide, a set of custom brackets that he had welded to make sure our ratchet straps didn't cross when the units were moved, that left two inches to spare on each side between Birmingham 911's building and their tank. As Cris wisely stated at the time, "An inch is as good as a mile!"

All told, removing the old units and installing the new ones required him to traverse that opening eight times, and he was an absolute pro! Not only did we get those two six ton capacity units installed and cooling the building to a comfortable 72 degrees, but I also added a heavy equipment operator that might be really valuable to my list of contacts as well!



**Figure 2 - There was a lot going on in a tight space at the back of the building, too.**

More cool is coming to our Red Mountain tower site in the way of our new ERI SHPX-8 eight-bay antenna. It landed at the site on Friday, February 24. Unfortunately, the box truck that was used to ship the ten different boxes didn't include a working



lift gate! No matter, Jack Bonds and I got everything off the truck and stored it in our old transmitter building until the tower crew can schedule a return visit to install the antenna. I'm sure I'll have more to discuss regarding that installation next month.

### Le Potato

Last month, I mentioned the inexpensive Le Potato SBC (single board computer). At \$30, it's a drop-in replacement for the Raspberry Pi in a number of instances. Since then, I've had two different experiences with them that leave me a little divided about them.

One instance involved a programmer friend at church that bought a couple of them. His intent was to use them similar to a popular Pi project, digital signage. These small boards are perfect to hook to the back of a flat screen TV to display any number of images or videos, and there are plenty of projects that do just that. His problem was that the Potato uses a different chipset than the Raspberry Pi.

Unfortunately, so far, it has turned out to be an exercise in frustration for both of us. It has required some software dependencies that we haven't been able to work out yet.

On the other hand, Cris had purchased one last month to see if it could be a drop-in replacement for the Raspberry Pi solutions we employ across the company. He installed the base Raspbian distribution and then he let me take a crack at installing our VPN on them. It ended up installing on the board relatively quickly and started passing data in short order.

So it seems that the board might be hit or miss depending on the project you want to try. Fortunately, the bundles we use seem to work well.

The next SBC I'll probably try is the Libre Computer Renegade, if for no other reason than my beloved Florida State Seminole mascot, Chief Osceola, rides on a horse named Renegade. We'll visit again next month and blessings to all of you.

---

## Tales From Cousin IT

by  
Stephen Poole, CBRE, AMD  
CBC Corporate IT Specialist

Networking has come a long way since I worked with a cantankerous Corvus Omninet (that's Greek for "Always B Crashin'") back in the 1980s. It offered a blazing 1 megabit of speed to a *y'uge* 10 megabyte network attached storage box. Bleeding edge, man!

A discussion with Mike Kernen in Detroit, a very sharp guy in his own right, gave me the idea for this article. Many of us now have multiple subnets (i.e., networks with different IP address blocks) in the same market. One subnet may need to "talk" to another. This requires (by definition) *routing* the data. We need some quick troubleshooting guidelines.

As I've said many times in the past, most Official References™ are written by Geeks to impress other Geeks. I don't play that way. Let's allow said Geeks to nitpick the arcane details. Should they chance upon this article, we'll imagine their neckbeards wobbling, spittle spraying, as they scowl at the screen.



### The Big Picture

We have studios, offices and transmitter sites filled with computers that lie to each other and try to convince us that we're being more productive. It's a mishmash of CAT5/6, network switches, wireless and microwave links. And don't forget the Internet; we share that chaos with the *rest of the world!*

Here's our first inaccurate-but-useful oversimplification: If it has a MAC address, treat it as Ethernet. Whether it's incoming Internet service from your ISP or a Cambium link to a tower site, you will probably be given an RJ45 or a fiber port. To keep this simple, let's focus on:

- IPv4 addresses internally (ex. 192.168.1.10)
- Windows (and/or compatible) PCs; and
- Ethernet (or compatible) for connectivity.

For the LAN (Local Area Network) examples, I'll use a typical "192" network (192.168.1.xxx) with a ClearOS gateway/router for



Internet access. Of course, for a very small network, you could use a little Linksys box. But I'll focus on ClearOS here; adapt to your config as needed.

I'll use some Windows commands here to examine things. Some commands need administrator privileges, so I go to the Start menu, type "cmd" in the search bar, then select "run as administrator" (over to the right in Windows 11). There are other ways to do it. It's your choice, but stay off my lawn.

One command that you can try right off is **ipconfig** to see the network settings on that PC. Then enter **route** to see the *default gateway* (more in a moment), which is simply the LAN address of your firewall/router. (So ... use **route** to find your firewall, if you're on a strange LAN.)

### Subnetting

I'm going to assume that you're at least familiar with IPv4 addresses, netmasks, DNS and other essentials. Wikipedia has some good info on the details. You might start with a search on "subnetting," then descend from there into all of the brain-roasting madness that you could desire.

We can't have the entire world running amok on One Giant Network. Things would get hopelessly jammed (as if they aren't already). During the creation of the Internet Protocol (IP) in the early 1980's, the idea of *subnetting* came about. A **subnet** is a small, isolated portion of a much larger network.

Where any subnet connects to a larger network, you'll need a **router** (and should have a firewall; ClearOS provides both). Isolated internal networks can reuse the same numerical IP address. I might have a printer at 192.168.1.78; you might have a video camera at the same address.

### The Address Resolution Protocol (ARP)

On a LAN, hosts find each other with an ARP broadcast to everyone on that subnet: "Who has 192.168.1.78?" That host should reply with its MAC address. Assuming it does – "I'm over here, at Ethernet address c0:3c:04:ab:1a:ee!" – the data is encapsulated and sent. Two well-known rules apply:

- Each host on a given subnet must have a unique IP address;
- The **broadcast address** is the highest host number.

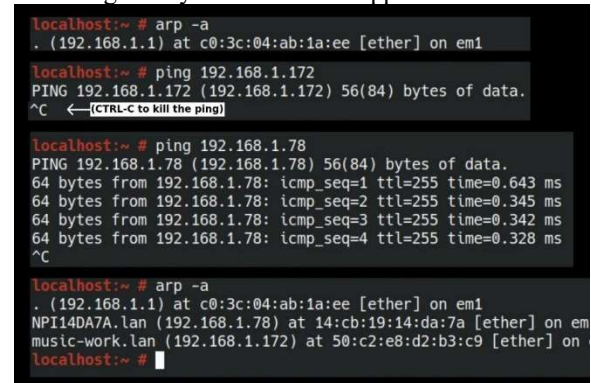
So ... don't duplicate IPs and *never* assign the broadcast address (ex., 192.168.1.255) to a host. If you break these rules, your network will appear to be indulging in psychoactive substances. Your

coworkers will wonder why it seems to work one minute, then locks up completely.

You can use the Dynamic Host Configuration Protocol (DHCP) to automagically assign IP addresses to each host; that helps a lot. When you're assigning static IPs yourself, you can either maintain a list to avoid duplicates, or see if your DHCP server will do permanent ("static") leases. ClearOS supports this, as does the Spectrum router in my home office. Check.

### Can't Ping? ARP!

This only works inside a given local network, of course. But your computer keeps a cache of recent ARP lookups; type "**arp -a**" in a terminal to see a list. Linux has an ARP command, so I'll show you an example from my home desktop (Figure 1). Right after booting, the ARP table was clear. Only the MAC address – "ether" – for my Spectrum Internet gateway at 192.168.1.1 appeared.



```
localhost:~ # arp -a
. (192.168.1.1) at c0:3c:04:ab:1a:ee [ether] on em1

localhost:~ # ping 192.168.1.172
PING 192.168.1.172 (192.168.1.172) 56(84) bytes of data.
^C ← [CTRL-C to kill the ping]

localhost:~ # ping 192.168.1.78
PING 192.168.1.78 (192.168.1.78) 56(84) bytes of data.
64 bytes from 192.168.1.78: icmp_seq=1 ttl=255 time=0.643 ms
64 bytes from 192.168.1.78: icmp_seq=2 ttl=255 time=0.345 ms
64 bytes from 192.168.1.78: icmp_seq=3 ttl=255 time=0.342 ms
64 bytes from 192.168.1.78: icmp_seq=4 ttl=255 time=0.328 ms
^C

localhost:~ # arp -a
. (192.168.1.1) at c0:3c:04:ab:1a:ee [ether] on em1
NPI14DA7A.lan (192.168.1.78) at 14:cb:19:14:da:7a [ether] on em
music-work.lan (192.168.1.172) at 50:c2:e8:d2:b3:c9 [ether] on
localhost:~ #
```

Figure 1 - ARPing some hosts on my home network.

When you contact any other host on the LAN, the *ARP broadcast* (or cache lookup) *occurs first*. Any active Ethernet-compatible interface *must* respond to an ARP query. They do *not* have to respond to a ping ... and later versions of Windows' firewall often block pings by default. If so, try this:

- Clear the target's IP from the ARP cache (**arp -d [ipaddress]**).
- Ping again, then do another **arp -a**.

If the host appears in the listing after that second ping, it's there and is connected. The lower part of Figure 1 shows where I pinged my HP LaserJet (at .78 – it worked) and my Windows 11 music workstation (at .172 – the ping *did not* work). But in both cases, the hosts responded to the ARP

request. So: both hosts are at least online. See the bottom **arp -a** listing.

### Gateways

So: let's say the netmask is applied to a request and your computer sees that it's an external IP address. Unless you've done some special routing, it will go to your *default gateway*. The router at that gateway will *masquerade* your request: it stores your LAN address in a table, along with a specially generated, unique source port number. The remote host replies with that special port number; your router looks in its table and returns the reply to your local LAN address.

You can't skimp on the firewall/router for a really busy network. It has to store the IPs and ports for *all outgoing requests* and then look them up on return. A little \$30 TrendNet box won't have the RAM or processor to handle a flood of gazinta and gazouta.

Incidentally, a quick way to disable Internet access on any given host is to simply clear the default gateway in that host's network settings. That's not foolproof, but it might work for troubleshooting. That host will still be able to see the rest of the LAN, but won't be able to use the InterTubes™. (Unless your operating system is really aggressive about guessing the netmask. I've run across this before: the OS *demand*s Internet. ClearOS can block specific hosts from Internet access; use that.)

The default gateway is where your host will try to send any packet that hasn't been ARP'd or routed in some other way. You can do all sorts of creative routing with the **route** command, but that's for another article. I'll also discuss WireGuard and the automagical way that it sets up a VPN in a later issue as well. For now, amuse yourself with **ipconfig** and **route** on your VPN to see what WireGuard has done.

### Routing Between Subnets

*Port Forwarding* is something that all of us have become familiar with. In ClearOS (as with most firewalls), you can specify a specific source (incoming) IP address, or use "0.0.0.0" to mean, "from anywhere." You choose an incoming port number, then tell the firewall where to route that to a host on a LAN IP address and port number.

To be clear: incoming/source and destination are from the viewpoint of whomsoever is handling the request *at that moment*. For example, if you use Putty to SSH into a server over the Internet, the *destination* at your end is that remote server. The request is sent; the server treats you as the *source*.

When it replies, it calls you the *destination*. Imagine yourself standing at the host in question, *at the moment that a decision is made*, to keep source and destination straight in your mind.

### Classless Inter-Domain Routing (CIDR)

Your ISP treats your Internet service as a *subnet* of its own Wide Area Network (WAN). In the WAN settings for ClearOS, you'll likely see some usual-looking netmask, gateway and DNS IP numbers.

But the netmask may be specified differently nowadays, ex., "5.5.5.5/29." The "/29" is a count of binary 1's in the netmask, starting from the left; in this example, equal to a netmask of 255.255.255.248. Only the last 3 bits of the IP address contain a host number in this little subnet, so we can have (at most) 8 IP addresses.

Google "CIDR calculator" and "subnet calculator" to play with these values online, but for example, 255.255.255.255 would be written in CIDR as "/32" – i.e., *all* ones (used for a single, specific IP address). 255.255.255.0 could be written as "/24" in CIDR.

### A "Block" of Static IPs

I'll finish with a common example. You may have a "block of 5" static WAN IPs that have been assigned by your ISP. It's actually a small subnet with eight (8) IP addresses, of which at least five (5) are usable. A network switch will "split out" the available (usable) IP addresses to different hosts. For example (see Figure 2):

Network: 12.33.50.16 (network "base;" see below)  
Usable 1: 12.33.50.17 (Web server)  
Usable 2: 12.33.50.18 (email server)  
Usable 3: 12.33.50.19 (FTP server)  
Usable 4: 12.33.50.20 (office access)  
Usable 5: 12.33.50.21 (studio/transmitter access)  
Gateway: 12.33.50.22  
Broadcast: 12.33.50.23

The "base" of your little subnet, 12.33.50.16, is a special case. It may or may not be usable, depending on your ISP. Some use the lowest IP in a "block of 5" as the gateway. Here in Birmingham, the base network IP address is used by our VoIP phone system, so we're actually getting a "block of 6."

Your actual block may be laid out differently. Broadcast will always be the highest possible IP address, but some ISPs use the "base" IP

as the gateway. *Check the provisioning data from your ISP.* If you don't have it, ask for (demand) it.

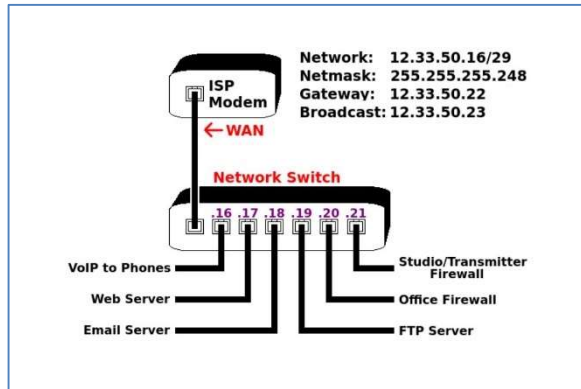


Figure 2 - A typical public IP address 'block.'

### That's It! (For Now)

Back to Mike Kernan and what inspired my fevered mind to type all of this. The problem he was having made me ponder how easily the Internet Control Message Protocol (ICMP), required for **ping** and **tracert** (traceroute), could be routed through a firewall to a specific host.

(Quick answer: not easily. You'll need fancy routing rules and a router that can support them. You ain't gonna do that with a little Linksys box, either. It's easier just to have a host inside that LAN that you could SSH, Mesh or VNC into and ping from there.)

But that's enough for this time; this is too long as it is. Lord willing, more to come! I may even tell you about the time I changed the language on that Corvis Omninet to Hebrew. I wanted to use Sanskrit because it's prettier, but MS-DOS 5.0 didn't support it.

The trademarks used in this article remain the property of their respective owners. Until next time, keep praying for this nation!

---

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

We recently got the news that we were going to shut down our Rockford, Illinois offices and studio. This studio was built in February of 2016 when the rules required a “main studio” within the principal community or within the city-grade contour. The studio got most of its use by our program director when he was out in that direction for promotions and such.

The studio was comprised of a Wheatstone IP-12 control surface with a Wheatnet console blade and various external equipment. Originally connected to the transmitter site with Worldcast Horizon codecs, we also connected back to our main studios in Hammond, Indiana using Tieline Genies. These gave us three audio streams in each direction which allowed us to go live through the Hammond studios, do voice tracking and even interaction with phone callers on the Hammond studio phones. All of this equipment is being repurposed in Hammond and elsewhere as we are looking at building a

podcast/voice tracking studio.

We still needed to provide a way for the program director to get voice tracks and such back to the studio in Hammond when he spends time in Rockford. I wanted to do this as inexpensively as possible, but still not sacrifice quality. It needed to sound like a studio and not a remote broadcast.

The Tieline codecs we had were not capable of using the transversal servers that make it easy for remote connections from home offices and public places, so, they were out of the question for now. I decided to take advantage of the podcasting software, Cleanfeed. It delivers quality audio over the Internet with easy connections.

The best choice was to use a laptop. Now a simple and not bad solution was to buy a USB mic to attach to the laptop. This might sound great for a podcast, but the aim was to sound like our other studio mics. This meant using an RE27 mic with a broadcast mic processor. We already had



an RE27 and Wheatstone M2 mic processor on hand after the studio teardown. It was really just a question of how we interfaced them with the laptop.

I had in mind to use a flight pack with rack rails for the M2, and so it made sense to find an interface that was rack mountable to make a nice package together. I chose the Behringer U-Phoria Mixer/USB Interface that was reasonably priced and only took up one rack space.



**USB and mic connectors on a panel in the flight pack make setup a snap.**

rack space that we customized with mic and USB jacks. These jacks make it easy for the non-technical personnel to connect their mic and laptop without having to stick their hands inside the pack.

The U-Phoria mixer interface was probably overkill with eight channels of mixing, but finding a unit that had mixing and was rack mountable was a challenge. With the jacks on the panel blank, all the user has to do is connect the mic and the USB cable from the laptop along with the power cable in the back and they are ready to go once they have their laptop connected through Cleanfeed.

With the M2 only needing one rack space, I purchased a 3 RU flight case. We then mounted the U-Phoria and the M2 into the rack rails and used the leftover space for a blank

The removable back of the flight pack has a zippered pouch. Even with the RE27 in its storage case, we are able to store the mic, stand and all the cables inside. This makes the pack an all-in-one case minus the laptop.

We have done some initial testing and the setup sounds great. It sounds like a studio mic with the caveat that the

environment it is used in will be a factor. An echo filled room will take away from the studio-like sound. The pro level of Cleanfeed does, however, have a feature to cancel out some of the echo.

We will soon be implementing the unit in real-life

circumstances. I am excited to see how it works for the program director when he is on the road.

The one thing I don't like about this setup is the weight of the pack once fully loaded. My guess is it is at least 30 pounds. So, a bit of a workout is involved when moving it.



**A zippered compartment in the back cover makes for easy storage and transport of cables, mic, etc.**



**Rocky Mountain Ramblings  
The Denver Report**

by  
**Amanda Hopp, CBRE**  
**Chief Engineer, CBC - Denver**

**Quick Recap**

I can't say I'm 100% recovered from my tonsillectomy, but I am doing much better and I appreciate those of you who have reached out. I was able to get back into the swing of things in February, which was good, although it was a slow month. Can I even say that? Thankfully, the transmitter sites are behaving, with only minor issues.

**Computer Replacements, Oh My!**

I did indeed replace numerous computers, starting with our call screener computers, last month.

Anytime, when you get a new computer, it just doesn't take long to set up. Most of them are nearly up to date with Windows. And even when they aren't, Windows has almost figured it out, so you don't have to wait all day for the updates to finish as it was in the days of Windows XP or even W7.

It is good to have the call screener computers done. I have not heard any complaints from anyone about the performance of the new machines, which is always a plus.

We also received three new IRU computers to replace three audio servers. These took a bit more work, but I was able to get them up and running within a day. Each one had its own issues when getting NexGen to work. Some of it was user related. I don't set up new audio servers very often, so remembering all the steps takes some work. Truth is, if I had looked at the handy instructions we typed up years ago for setting up NexGen computers with Wheatnet, I would not have had any issues, except for the last audio server.

I am still not sure what happened with that last one, but when we put it online and hit play in NexGen, it would automatically eject the item being played. I ended up calling RCS support and they had to get a more experienced person on the case. She ended up having to open Play.exe and change the audio devices for each play device. Restarted the

program, then put it back the way it was supposed to be. This did fix the issue and the station was able to get back on air and play properly.



We used those older audio servers to replace the three transmitter desktop computers that we had. Those computers were getting really old, as we usually just put in ones we've retired. This time is no different. Since the audio servers are on a timed replacement, they really weren't that old (five years).

I ended up reinstalling Windows 10 on the machines and put them at each site. The next step is to replace the hard drives with solid state drives. Thankfully we have them already as I had bought them and put them in the transmitter site computers we were replacing. I pulled them out of those computers and will clone them in the near future. I was able to get KLZ done as we had other work to do at the site. All that's left is KLTT and KLVZ, both of which will get done early this month.

**Ubiquiti**

While at KLZ, we replaced the Ubiquiti NanoBridge units that we had on the front of the building and on the barn. We use these to allow us a security camera at the barn looking at the entry gate to the property. The unit at the building is plugged into the security NVR and the camera on the barn is plugged into the NanoBridge.

Getting NanoBridges is nearly impossible as Ubiquiti has moved on. We purchased some LiteBeams last year so we could also move away from the NanoBridges. However, for some reason, despite working on the ground, once on the side of the building, the unit would lose its mind and reset to default. We were thinking maybe RF, however the nearest tower is 450 feet or so away and was off when we initially tried using the LiteBeam. We finally gave up and left the NanoBridges in place.

I monitor our security cameras on a near daily basis and noticed that at times, the barn cam would not respond. I would log into the computer at

the site and view the NanoBridge on the building and would see zero connections.

I knew we needed to replace these units. Going with Cambium PTP450i units for the KLDC link freed up two more PowerBeams, so we went ahead and put those up with no issues. Well, almost. The only real issue was that the mounting bolts were just too long for where we needed to mount the radios and antennas. Nothing that couldn't be fixed with a hacksaw.

The units connected right up, and so far, they are working as they should and the camera is staying connected to the system. These units are a bit of overkill for the application, but it's the price you pay for security – and it's a good use of an otherwise unused asset.

I would like to figure out the LiteBeams, and once warmer weather is here, I may play around with them some.

### **XDS-IP Weirdness**

We have one XDS-IP unit that allows us to carry one show. Over the last couple weeks in February, I've received reports of the audio cutting in and out. I can physically look at the unit itself, and the status lights are green. No alarms.

After getting up with technical support, I was told the unit had no internet. To make things weird, I logged in locally and ran a NOC test, which showed successful. This, of course, was foreign to support. We ran a couple more tests and he assumed the unit went crazy.

After overnighting me a new XDS-IP unit, I plugged it in with the same result. I began messing around. The old unit is on our bench where I have several five-port switches set up for the various networks: Office Network, Transmitter/NexGen Network, Wheatnet Network, and an unused switch. I plugged the old unit into power and connected it into the office network. We use a static IP, so I made sure the unit had the correct gateway. The unit came up and connected right away with a good "signal."

If I move the network cable over to the transmitter/Nexgen network and change the gateway to the proper one for that network, it holds. As soon as I reboot the unit, it loses it. We have not changed anything on our end to have caused this.

I am still working with tech support and am doing what I can to try to resolve the issue. We can easily keep it plugged in to a different network, but it should work where it was originally. I have also

confirmed the new unit does the same thing.

I hope to have an update for you next month. If you have experienced this and have any ideas please shoot them my way!

### **Spring is Upon Us**

March is here, and that means that I will begin seeing those beautiful spring skies soon enough. There is always a change where the clouds



**A beautiful stack of new audio servers in the Denver TOC.**

start looking different. Winter stratus become spring cumulus. Late in the month storm clouds can be seen out east. Trees start budding out, and that means that warmer weather is almost here. I am looking forward to this change. I will be able to start planning out transmitter work.

Coming up in June, we will finally be getting the security systems at the KLTT and KLVZ sites updated. KLZ was already updated a few years ago. It will be good to get these units back up and running properly so we have no doubt we are fully secured.

That about covers it for this edition. I pray you all stay safe and well.

---

The Local Oscillator  
March 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*



Corporate Engineering  
2821 S. Parker Road • Suite 1205  
Aurora, CO 80014

email address: [crisa@crawfordbroadcasting.com](mailto:crisa@crawfordbroadcasting.com)