

An LD's Guide to Summit's Computer & Lighting Networks

by Wendy Roome 11/6/2022

Summit's computer networks (Ethernet & Wi-Fi) are tied into the lighting control network (DMX). This article explains how they interact.

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Overview

Summit has two computer networks: BettyK and sph-artnet. BettyK is the main one, and connects directly to the internet. Sph-artnet is a secondary network. It connects to BettyK, and from there to the internet. The router for BettyK is in the furnace room, the router for sph-artnet is in the balcony.

Summit has three lighting controllers: an ETC Element2, an ETC Nomad (running on a Mac Mini in the balcony) and QLab (running on our MacBook Pro).

QLab lighting is our legacy system, and predates the Element2 & Nomad. But it's fully functional, and can control LEDs and moving lights. We've retained it in case an LD would prefer to use it. Also, while the Element2 is extremely powerful, it's also difficult to learn. QLab lighting is much easier to learn.

Instead of outputting DMX directly, all of our lighting controllers send network commands over the sph-artnet ethernet to an Ethernet-to-DMX converter box. This uses the ArtNet protocol, a standard protocol for sending lighting control data over a computer network. We have to do that for the Nomad and QLab lighting controllers – they're computer based, and cannot output DMX. The Element2 can, but it's easier for it to output ArtNet like the others.

Our normal practice is that during rehearsals, the LD creates cues on the Element2, which we put on a table in the back of the auditorium. After the tech rehearsal, and once the LD is reasonably confident that the cues are set, we transfer the show file to the Mac Mini in the balcony, and run the show with ETC Nomad rather than our Element2. There are several reasons:

- The balcony is very cramped, and the Element2 is big & bulky.
- It's difficult to tie a rope to the Element2 and lift it up into the balcony.
- Most of our operators don't know ETC EOS, and are intimidated by the interface.
- We normally use QLab as a master controller, and the operator doesn't touch the lighting controller directly (more on this later).

That said, if you, as LD, to run the show yourself, and you run it directly from Element2, you can. You just have to figure out where to put it in balcony and how to get it there safely.

ArtNet Ethernet to DMX Interface

ArtNet is a standard ethernet protocol for converting ethernet commands to DMX commands. Summit currently uses an EntTec ODE Mk2 interface. It's in the balcony, next to the sph-artnet router.

The front side has the ethernet input jack. The DMX output port is on the back.

Without getting overly geeky, the active lighting controller – Element2, Nomad or QLab – sends Ethernet “DMX levels” commands to the EntTec box up to 40 times a second. Each command has the levels for all 512 DMX channels. The EntTec box outputs those levels to the dimmers as a DMX packet. The EntTec box remembers the levels from the most recent packet, and keeps outputting DMX packets even if the lighting controller shuts down.

So what happens if more than one lighting controller sends DMX level commands to the EntTec box at the same time? It's very simple: the EntTec box keeps the most recent one and discards the other. The good news is that makes it easier to switch from Element2 to Nomad: just turn off the Element2 and start Nomad. The bad news is that if both send commands at the same time, the lights will probably flicker light crazy.

We normally leave the EntTec box, and the sph-artnet router, turned on at all times.

One last geeky detail: the DMX interface is “plug & play.” The lighting controller – Element2, Nomad or QLab – uses ArtNet's built-in discovery protocol to learn DMX interface's IP address. So you do NOT need to configure that address into the controller.

QLab As Master Controller

We normally use QLab as the master controller for the show. QLab handles sound & video cues directly. For lighting cues it sends “GO” commands to the lighting controller at the appropriate point in the cuelist.

In effect, QLab is the Stage Manager for the lighting controller, and sends commands like “Cue 14.6 GO.” QLab determines **when** a lighting cue happens. The lighting controller determines **what** the cue does – levels, timing, etc. This is a common practice in many theaters; ETC even has a web page describing it:

[https://support.etcconnect.com/ETC/Consoles/Eos Family/Software and Programming/Triggering Eos from QLab using OSC](https://support.etcconnect.com/ETC/Consoles/Eos%20Family/Software%20and%20Programming/Triggering%20Eos%20from%20QLab%20using%20OSC)

Here are the advantages:

- One operator handles sound, video & lighting.
- When sound & lighting cues occur together, we use QLab's sequencing controls to make them look like one cue to the operator. For example, if we want a light fade a second after the scene change music starts, the music cue can auto-continue into the light cue with a one second delay. So the operator only pushes “go” once, and doesn't have to worry about which goes first.



And here are the disadvantages:

- We have to add “lighting go” cues to QLab for all the lighting cues.

I have a program which automates some of that: it gets the EOS & QLab cue lists, compares them, and automatically adds the “lighting go” cues to QLab. But someone still has to move those cues to the appropriate place in the cuelist.

Typically we do that shortly after the tech rehearsal – or whenever the LD is confident that the cuelist is complete.

EOS Remote Focus Apps

Our Element2 and Nomad work with two ETC remote focus apps: RFR Classic and RFR Remote Control. Both are available from Google Play & the Apple AppStore. Classic is free, Remote Control costs \$50. Remote Control does a lot, but I found the advanced features confusing. Classic is limited to setting intensity levels for channels. But that’s easy to do, and when focusing, that’s all you really need.

For more information, see ETC’s web page:

<https://www.etcconnect.com/Support/Apps/Focus-Remotes.aspx>

DMX Splitters & Cabling

DMX-512 is extremely useful for distributing control signals to dimmers and smart instruments, and the ability to “daisy chain” one unit to another is very handy. But DMX has a few “gotchas”:

- Like all digital signal lines, DMX lines can have short “noise bursts.” For example, suppose the lighting controller constantly sends “set dimmers to 75%” down the DMX line. But if there’s a noise burst, for 1/20th of a second, the dimmer at the other end of the line sees “set dimmers to 0.” This wasn’t a problem in the old days, because tungsten filaments can’t respond that fast. But LEDs can, and noise bursts can cause noticeable flickering.

We avoid noise problems by using good quality DMX lines, not daisy chaining too many instruments together, not running the cables all over the place, and using a DMX terminator at the end of the line.

- Unlike power lines, you cannot passively split a DMX feed into two or more outgoing lines by simply connecting the wires together.¹ You need an active component called a DMX Splitter. This reads control data from the incoming DMX feed, buffers it, and regenerates it on each output leg. Summit has several of these 1-to-4 DMX splitters:

¹ Yes, sometimes you can get away with a passive “wired DMX splitter.” It does work. Sometimes. Until you (say) daisy-chain another instrument into the DMX line and everything goes crazy. So we don’t take the chance.



For that reason, Summit's DMX lines form a "tree." I'll give a detailed diagram later, but here are the basics:

- The root of the tree is the ArtNet-to-DMX interface in the balcony.
- That feeds a 4-way DMX splitter in the balcony. Three outputs go to the dimmer & LEDs in the balcony, and one output goes to the basement.
- That line feeds another 4-way DMX splitter in the basement. One line goes to the five basement dimmers, one goes to the dimmer pack on the house pipe, one goes to the stage manager's desk for on-stage LEDs, and one goes to the stage left front wall, for future expansion.
- The line to the stage manager's desk feeds a pair of 4-way splitters. Seven of those outputs have DMX lines that end at the stage right end of the lighting pipes. The eighth is a spare.

Summit's Ethernet & Wi-Fi Networks

Trigger Warning: Geeky computer stuff

Here's a diagram of Summit's computer networks. We've configured the NetGear router's DHCP server to reserve IP addresses for several of the devices in the balcony:

- Element2 port 1: 192.168.42.101
- Element2 port 2: 192.168.42.102 [normally we use port 1 and ignore port 2]
- EntTec Interface: 192.168.42.103
- MacMini/Nomad: 192.168.42.104

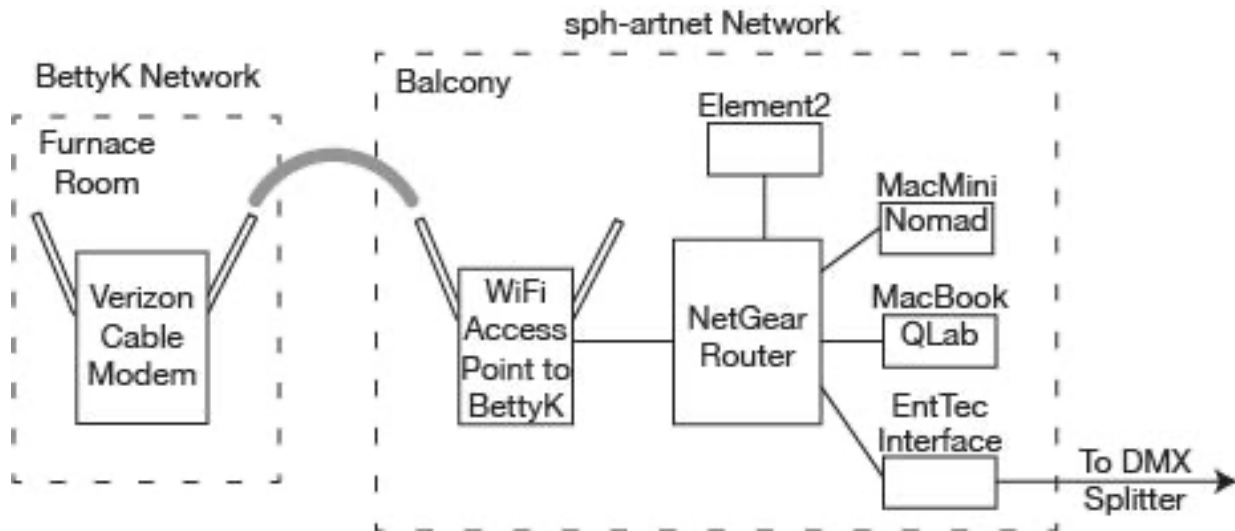
The addresses are written on top of the router, as are the Wi-Fi and admin passwords. But please don't change the addresses or passwords unless necessary.

The WiFi access point is a small box in the balcony which provides the upstream link from sph-artnet to the outside internet. It also doubles as a range extender for BettyK.

Note: Yes, it would be better to run an ethernet line from the balcony to the cable modem in the furnace room. But that requires drilling through walls & floors.

Also note that the sph-artnet router is a firewall and its devices are on a local network. During a show, there is a lot of traffic between the lighting controller (Element2 or Nomad) and the EntTec interface, and between QLab and the lighting controller. All of that traffic is local: none goes up to BettyK.

During a show, all traffic uses wired ethernet connections, not Wi-Fi. During rehearsals, when the MacBook is down in the auditorium, it uses Wi-Fi. But once it's in the balcony, we plug it into the router's ethernet port and turn off Wi-Fi.



Summit's DMX Network

