WPRM WiFi Upgrade July 2019

- Kerry Cochran

Over the last few years, the WPRM WiFi system has not been reliable at the museum for the use of our staff and volunteers.

A few months ago, Kenneth Finnegan investigated the connections, routers and other network systems at the museum. Once he completed this task, he discussed with Paul Finnegan and me (the Signal Department) the shortcomings of the way this system was configured.

During one of the Signal Department meetings that followed, the three of us discussed several options to make the WiFi system more robust and remove some of the equipment that was causing problems. I made the decision to fix the existing WiFi system, and directed Kenneth to purchase the required equipment.

On Friday July 12th, Kenneth brought the new equipment with him and after the museum closed, installed the new WiFi system. On Saturday morning July 13th, I tested the new system and advised Kenneth to decommission the old system. (Well not all of it. There is still one WiFi router working so if something did not work out, the old system would still be in limited operation.)

The new WiFi System is installed and access points are located around the museum. One is in the main shop area, one in the window in the southwest corner of the shop building and one in the members' lounge.

This should give coverage in most of the building and the lounge. There is limited coverage in the sleeper car at this time with discussions about the possibility of adding another node to get better coverage there. However, this is dependent on donations to purchase the equipment. During the FRRS Board of Directors meeting on Saturday July 13th, I advised all members and directors (that were present) that the new system had been installed and it was working. The new network name and password is in the same location as the old one and/or can be found by asking one of the officers or directors.

The equipment costs to date have been covered by Kenneth Finnegan and Kerry Cochran.

Questions on this system should be directed to the Signal Department.

Signal Department Technical Notes of July 2019 WiFi Upgrade

- Kenneth Finnegan

This WiFi deployment at the museum has been one of the most challenging network deployments I've worked on as a networking consultant. Not only are steel buildings and rail equipment very good at reducing WiFi coverage, the harsh weather in Portola made me hesitant to deploy any access points or cabling outdoors.

During this work on the museum network, the following ranked priorities were identified for the museum Internet service:

New Museum WiFi installed by Kenneth Finnegan & Kerry Cochran. Access points are now in the Silver Debris (crew lounge), southwest corner of diesel shop and near the Museum Store - photos by Kerry Cochran

1. Internet for the Museum Store for their point of sale and inventory systems
2. Internet for FRRS groups such as the Mechanical Department, Operating Department, Historical/Archives Department, etc. to enable and support their activities
3. Internet as a convenience for museum staff and volunteers to make their time spent on museum property more enjoyable

After a survey of the existing network, I proposed the best current option for the museum's network was to deploy three Ubiquiti UAP-AC-M mesh access points. These access points are special in that they don't all require being hard wired back to our Internet router with Ethernet cables, but can form a wireless mesh to extend coverage beyond the range of a single access point. As long as at least one of these access points is connected to the Internet, and all of the access points can see each other, they will function as expected.

The first access point is mounted on the north wall of the shop, with an Ethernet cable running down to the museum's router in the storage room and is the main uplink for the whole mesh. The second access point is mounted at the south-west corner of the shop, with an Ethernet cable run down to an outlet only for power. It can see the first access point from across the shop and relies on the first access point to be able to serve the Internet to users. The third access point is mounted on the interior wall of the member's lounge, again using an Ethernet cable only for power, and relies on being able to see the second access point across #3 and #4 rail for Internet. The system also includes a UniFi Cloud Key installed in the storage room; the UniFi Cloud Key is a small device which acts as a supervisor over all the Ubiquiti devices deployed across the museum to configure and monitor the access points.

This WiFi deployment should be an improvement on what the museum has had before, but does have some known deficiencies:

1. Users in the members' lounge rely on their traffic hopping from the third access point, to the second access point, to the first access point. This is generally not recommended to have traffic take multiple wireless hops since it decreases network performance, but was deemed acceptable since the museum's Internet connection is currently 6Mbps down/0.75Mbps up, so this slower WiFi mesh topology is still faster than the museum's connection to the Internet at large. It would be possible to correct this by running a CAT5e cable from the storage room to the second access point, but this would require running a cable through the rafters of the shop, which would require significant effort.
2. Since the network connection between the shop and member's lounge is wireless, a poorly positioned piece of rail equipment on #3 rail has been observed to degrade the network performance. This could be corrected by running an Ethernet cable between the shop and the lounge, but this would add a significant expense to the deployment since this would require fiber optic Ethernet equipment to go between the two buildings, and either an aerial cable strung or a significant amount of trenching effort to get between the two buildings.
3. WiFi coverage is still not satisfactory in the Edenwold sleeping area, due to it needing to penetrate both the metal walls of the member's lounge and the Edenwold itself. An additional access point installed in the Edenwold is a possible solution, but until the funding and labor to correct this is secured, it is recommended that members either book rooms on the north side of the Edenwold or stay in cabooses if they would like to have Internet access from their sleeping accommodations.

During this WiFi install, I also discovered that the current core Ethernet switch used by the museum has been the source of the radio interference likely experienced by any members who have tried to use the museum's radios around the shop. To correct this, I replaced the noisy 3Com switch with a new Netgear switch from my personal inventory, which has corrected the issue.