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Fix bad patch cables at City Hall

Report updating Management/Board on the issue
By Aristo Networks LLC

Background of Issue

QLIFE developed/completed a fiber optic loop in 2002 and at that time few efforts had been expended towards identifying a good location for QLIFE's CO (Central Office). Originally it was expected to use CGCC for this function, but the location was changed to the basement of City Hall and a small room was developed for said purposes. No planning was developed for backup generator growth (QLIFE would just tap into the City Hall generator) or room expansion. At this time, the project was still in infancy stages and additional costs for such purposes were not considered necessary. Over time as QLIFE's required more space additional rooms in City Hall were developed for expansion until the point no more available space (or power) was available at City Hall. Aristo Networks was provided direction to "make it work" as best as possible, which we have successfully done for more than two decades.

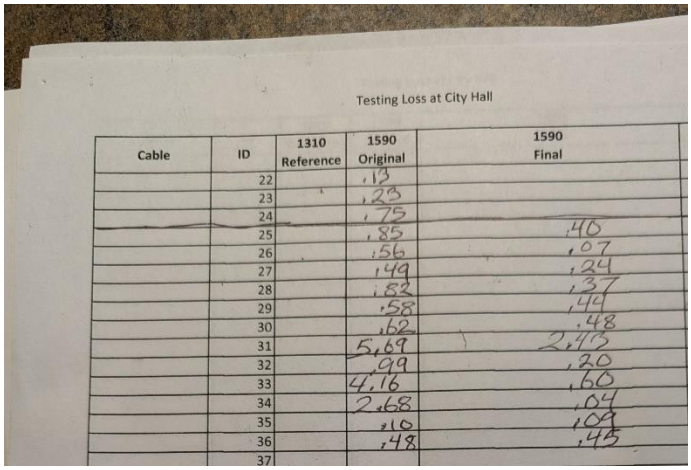
In efforts to increase the functionality/density of City Hall QLIFE placed a Leviton HDF (High Density Frame) patch panel at City Hall to allow for a high quantity of extremely compact patching of fiber connections. This high density frame requires compressed space allocation for patch cables. QLIFE

brought additional (outside) fiber cables to this HDF patch panel and additionally purchased high density pre-terminated patch cables (up to 144 patches per cable) for purpose of connecting from QLIFE's HDF frame to customer racks. The first group of patch cables QLIFE purchased worked great at 1310 frequency (a lower frequency utilized often on short fiber runs), but showed unacceptable levels of loss at higher frequencies. Aristo Networks reached out to the manufacturer (considerable time had passed between purchasing the cables and placing the cables), however the manufacturer did not represent that they were willing to fix/warranty the cables and it was finally identified that the costs associated with paying your contract staff (Aristo Networks) for their time in attempting to pressure the manufacturer could easily surpass the original costs of the cables purchased. The decision was made to purchase some new cables (a smaller batch this time) from a different vendor and to move on. The new cables were purchased and showed better characteristics at higher frequencies, however there were issues with these cables as well in that some of the fibers were considerable shorter than other fibers in a patch group making safe routing within the HDF frame problematic.

It was then decided to re-visit the old cables to better identify what the root cause of the issue was (for the high loss at high frequencies). The interesting factor was that only a percentage of the fibers showed these bad characteristics of loss at higher frequencies. An additional interesting factor was that there appeared to often be groups of fibers where the fibers were bad. In other words, the issue did not appear to be due to the fiber cable itself (as some fibers were fine), and additionally, it appeared that the issue was associated with a particular process/component associated with groups of fibers.

Root Cause Analysis Method and the Associated Fix

Aristo Networks originally went through a couple of the cables and documented the loss at both 1310 and 1550 frequencies for each fiber. Next Aristo Networks took one of the cables and attempted to identify if loss would change as bends were applied to



Testing Loss at City Hall

Cable	ID	1310 Reference	1590 Original	1590 Final
	22		.13	
	23		.23	
	24		.75	
	25		.85	.40
	26		.56	.07
	27		.149	.24
	28		.82	.37
	29		.58	.49
	30		.62	.48
	31		5.69	2.47
	32		.99	.20
	33		4.16	.60
	34		2.68	.04
	35		.10	.09
	36		.48	.45
	37			

different sections of the cable. It was identified that applying pressure / bending the fiber near or at the splice tube generated changes in loss. Next, Aristo Networks peeled back the protective shrink rubber at the splice tube.

A microbend of the fiber was visible inside the splice tube. Next Aristo Networks used a pipe cutter and made a circular cut around the splice tube which allowed the fibers to extend out thus removing the microbends of the worst offending splices. And then lastly, Aristo Networks secured the previously opened splice tube by re-applying heat shrink over the splice tube. While not every splice could be fixed using this method, nearly all splices could be brought back into spec using the above method.

Conclusion

Aristo Networks intends to continue with process in fixing the rest of the existing cables. This should allow us to utilize these cables for patching to current ISP racks located at City Hall.

Additional Thoughts / Lessons Learned

Working with the HDF frame is great in that it provides considerable (on a magnitude of about 500%) greater space utilization than working with standard patch panels. However, this compression comes at a cost. I found that when contractors developed new outside fiber cables into the HDF frame it took considerably longer for them to splice the fibers. I would guess maybe 2 to 3 times longer. This is due to the additional time required for preparation and routing in such tight spaces. Additionally, I have found that the routing of pre-made patch cables takes considerable efforts (aside from the issues listed above associated with bad patch cables). Just routing and securing of cables takes considerable time and effort making sure microbends are not introduced, and additionally to make sure secure space is available for future expansion(s).

In hindsight, as QLIFE grows, and as we develop new colocation centers(s) I would probably change from premade patch cables to hard splicing all connecting patch panels. While this currently requires bringing down specialized fiber splicers from Portland Metro to perform this work, I would not be surprized that as QLIFE grows, eventually locally splicers are brought onto the team, which should make this additional work more cost effective.