Episode Book

EPISODE #5665

Fiber Through the Conduit: Bends, Dust, and Pull Socks

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SYNOPSIS

A twelve-meter Cat6 run terminates badly and quietly falls back to 100 megabit — the classic silent failure where the link light comes on and everything looks fine. Daniel already owns two SFP+ switches, a pair of 10GBASE-SR multimode transceivers, and an OM3 LC cable that works between them. So why not run the fiber through the conduit instead? This episode digs into how fiber actually handles tight bends compared to copper, whether transceivers stored in a Ziploc bag are still usable, how to attach fiber to fish tape without destroying it, and when a cleaning pen actually earns its keep. Along the way: why 100 megabit is a diagnostic signal rather than a mystery, why kinked copper can pass continuity and still cap your speed, and the pull sock trick that lets you skip termination entirely.

TRANSCRIPT



Corn

Okay so the run was maybe twelve meters. Twelve meters of Cat6, two keystone jacks, one crimp on each end, and somehow it comes up at a hundred megabit.



Herman

Which is the most insulting possible result, because it isn't broken. It works. It just works like it's twenty years old.



Corn

And that's what Daniel ran into. He did an Ethernet run between two rooms, the termination didn't take, he got a hundred megabit, and he spent an evening re-terminating and re-terminating, standing there with the crimper, thinking there has to be a better way. Which is where the fiber comes in.



Herman

Right, and he already owns the fiber. That's the part that makes this interesting.



Corn

He's got two switches with SFP cages, a pair of 10GBASE-SR multimode SFP+ transceivers using duplex LC connectors, and an OM3 LC to LC cable he'd already run between those two switches successfully. Worked great. So his question is whether he can put that same fiber through the conduit instead. How fiber handles tight bends compared to Ethernet. How sensitive it really is to dust, given he's had the transceivers sitting in a Ziploc bag in a box. Whether there's a standard way to attach fiber to fish tape and protect it during a pull. And then the cleaning pen he bought, matched to the fiber type, never read the manual on, because he figured it'd be useful if signal quality inexplicably dropped after he'd been working on it. When would it actually earn its keep.



Herman

That's a good cluster of questions because they're all the same question wearing different hats. Every one of them is about whether fiber is actually as delicate as its reputation says it is.



Corn

And the hundred megabit is the thread that ties it together. Start there.



Herman

The hundred megabit is not a mystery. It's a diagnostic signal, and it's a very specific one. Gigabit Ethernet needs all four twisted pairs. All eight conductors, terminated correctly, end to end. A hundred megabit Ethernet, 100BASE-TX, only needs two pairs. Four conductors.



Corn

So the link falls back to the standard it can actually achieve.



Herman

The PHY negotiates down. It doesn't fail, it doesn't throw an error, it just quietly settles at the fastest thing it can do on the pairs that still work. Which is why it's such a nasty failure. You plug in, the link light comes on, you get an IP, everything looks fine, and you're at a hundred megabit and you have no idea why.



Corn

And the causes are all boring. One conductor not fully seated in the RJ45. A nick in the jacket that took out a pair. T568A on one end and T568B on the other. A crimp where the contact didn't quite pierce the copper.



Herman

A marginal crimp is the one that gets people, because it's intermittent. It tests fine, it works for a week, then it warms up and the contact opens and you're back at a hundred megabit and you're questioning your whole life.



Corn

So what's the answer? Because he clearly didn't have one, he was just re-terminating and hoping.



Herman

A cable tester that reports per-pair continuity. Not a pass-fail tester, one that shows you each pair individually. They're cheap. And they turn a two-hour guessing game into a ten-second answer, because it just tells you which pair is dead.



Corn

Which is the actual "there has to be a better way" moment for copper.



Herman

And it's also why fiber starts looking attractive, because fiber doesn't have eight conductors to get wrong. It's a strand per direction. Light goes through or it doesn't.



Corn

So let's take his actual question. Can he run the 10GBASE-SR multimode through the conduit.



Herman

Yes, and this is a well-trodden path. 10GBASE-SR over OM3 is rated to three hundred meters. Over OM4, four hundred. His two-room run is probably under thirty meters. He is not remotely close to the limit.



Corn

And he already knows the optics and the cable work together, because he ran them between the two switches.



Herman

That's the proof of concept. The only new variable is the conduit.



Corn

So what actually limits it in the conduit? Fill?



Herman

Fill is barely a factor. Fiber is dramatically thinner and lighter than Cat6 or Cat6A. A duplex LC cable is about a two millimeter jacket. In a conduit sized for copper, it's using a rounding error of the cross-section. It pulls easier than copper does in the same pipe.



Corn

So the constraint isn't space.



Herman

The constraint is bends and abrasion. That's where you can actually hurt it.



Corn

Which is his second question, and it's the one where fiber has a real advantage, if you buy the right fiber.



Herman

Copper is the one that suffers here, and people don't expect that. Cat6 has that plastic separator spline down the middle. Cat6A adds foil or braid on top. Both of those make the cable stiff and hard to pull, and when you force it around a tight corner it kinks. And a kinked copper cable is the worst kind of failure, because it can still pass continuity while failing at speed. Which is another silent hundred megabit trap, same symptom, different cause.



Corn

So he could fix the termination, get gigabit, and still be capped because he kinked the cable pulling it.



Herman

Entirely possible. And he'd never know, because the tester would say the pairs are fine.



Corn

What's the number for fiber?



Herman

Standard fiber minimum bend radius is about ten times the cable diameter for a permanent install, and about twenty times during the pull. So a two millimeter duplex cable, roughly twenty millimeters static. Eight tenths of an inch.



Corn

That's tighter than I'd have guessed.



Herman

It's tighter than most people guess. Fiber's reputation for fragility is mostly wrong. And then there's the upgrade, which is the actual answer to his worry. Bend-insensitive fiber. Modern OM3, OM4, OM5, and single-mode all come in bend-insensitive versions, and single-mode often carries a G.657 marking for it. Those tolerate bends down to roughly seven to ten millimeters with negligible loss.



Corn

So if he's staring at a tight elbow in the conduit, the fix isn't technique, it's buying the right cable.



Herman

That's the direct answer. Bend-insensitive multimode. Standard OM3 will work in most home conduit, but bend-insensitive removes the anxiety entirely.



Corn

And the practical rule either way?



Herman

Avoid sharp ninety degree elbows. Use sweep elbows where you can. And never pull fiber around a corner under tension. That's the moment attenuation spikes or the cladding cracks.



Corn

Now, the multimode versus single-mode thing. Because I know this is a live argument.



Herman

It is, and it's worth thirty seconds because it's the one place where the advice for Daniel and the advice for a stranger differ. There's a real camp that says go single-mode only for new installs. Their argument is that single-mode is cheap now, it's more future-proof because the higher speeds use parallel wavelengths, and that we've pretty much hit the end of the road for multimode.



Corn

And the other camp.



Herman

The other camp says multimode optics and patch cables are cheaper, especially for non-Ethernet uses like extending a DisplayPort signal, and that OM3, OM4 and OM5 all do ten gigabit fine at any distance you'd run in a house. Which is true.



Corn

So for Daniel specifically.



Herman

He already owns the OM3 and the 10GBASE-SR transceivers. Staying multimode is the pragmatic call. But if he were starting from nothing, single-mode is the emerging default, and that's worth knowing.



Corn

Okay. So the conduit is viable, fiber handles bends better than copper, and he's already got the right gear. Which means the rest of this is about what happens when he actually pulls it, stores it, and plugs it back in.



Herman

And that's where fiber stops being forgiving in the way people expect and starts being unforgiving in a way they don't.



Corn

Dust.



Herman

Dust. Fiber end faces are sensitive, and this isn't folklore. A single dust particle, tens of microns across, sitting on a nine micron single-mode core, or even a fifty micron multimode core, can block or scatter the light. Best case you get high insertion loss, worst case you get an intermittent link, and the actual worst case is the laser focusing on that particle and burning the end face.



Corn

Burned end face meaning permanent.



Herman

Permanent. You're not cleaning that off. That's why "clean your connectors" is close to a religion in telecom. It's not fussiness, it's that the failure is expensive and invisible until it isn't.



Corn

So his transceivers. Ziploc bag, in a box. Are they fine?



Herman

Almost certainly yes, with a caveat. The transceiver's optical port is recessed, and it usually has a dust cap or a shutter over it. A Ziploc bag in a box is a completely reasonable home storage environment. The transceiver body is not the fragile part.



Corn

So what is?



Herman

The ferrule end face of the connector that mates into it. If the transceivers went into the bag with their dust caps on, they're fine. If the cable connectors were left bare, those are the ones to clean before they go anywhere near a port.



Corn

And the rule of thumb.



Herman

If it's been out of a bag, clean it. Even a connector you know is good picks up dust the second it's exposed. You don't clean it because it looks dirty, you clean it because you can't see whether it's dirty.



Corn

Which brings us to the pull itself. Because this is the question where I think he's actually closest to a real answer, and he doesn't know it.



Herman

He's right that there's a standard way. There's a whole toolkit. The main tool is a pull sock. Sometimes called a cable sock, or a lubed cable sock. It's a woven mesh sleeve. You slide the cable into it, and the mesh grips the jacket by friction and tightens as you pull.



Corn

And the point of that is where the tension goes.



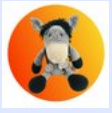
Herman

The tension gets distributed over a length of jacket instead of concentrating at one point. That's the whole trick. You're not pulling on the connector, you're not pulling on the fiber, you're pulling on thirty centimeters of mesh gripping thirty centimeters of jacket.



Corn

And there's a quote I like from a cabling thread on this. Somebody said a lubed cable sock can get through lots of places and save a ton on termination.



Herman

Which is the real argument. If you can pull pre-terminated cable, you skip the termination step entirely. And termination is where Daniel's whole evening went.



Corn

So walk through the actual pull.



Herman

You attach the pull sock to the fish tape. You tape over the connector ends, or use protective caps, so the LC connectors can't snag on anything. You feed from the end with the connectors, pulling the slack through, so the connectors are never dragged around a corner. And you never, ever pull by the connectors.



Corn

Lubricant.



Herman

Purpose-made cable pulling lubricant. Water-based, fiber-safe. It dramatically cuts friction in the conduit. What you don't use is grease or anything oil-based, because it can attack the jacket.



Corn

There's a trick with the fish itself.



Herman

There is. A lot of cablers don't use a steel fish tape for this. They use a strip of yellow tongue. That's the nylon tongue out of a chipboard flooring panel. It's stiff, it's cheap, it's smooth, and it doesn't have the sharp edges a metal fish tape has. You push the yellow tongue through, pull a cord through with it, then pull the cable with the cord.



Corn

Yellow tongue. Good color for an episode.



Herman

It's a good color for a conduit, too.



Corn

Tension limit.



Herman

Fiber has a maximum tensile load. For patch cable it's often fifty to a hundred newtons. Which is not a lot. The practical version of that number is: if it feels like it's fighting you, stop. You're probably about to damage it. A pull that needs brute force is a pull that's going to fail, it just might fail next week instead of now.



Corn

There's a bonus move for anyone doing this from scratch.



Herman

Pulling pre-terminated MPO cable. Twelve cores in one jacket, with breakout fans at each end. It's cheap, and it gives you a dozen strands in a single pull, which is far cheaper than splicing. For two rooms it's overkill. But it's the move if you're doing a whole house.



Corn

Okay. So the pull is solvable. Which brings us back to the pen.



Herman

The pen. He bought a one-click pen-style cleaner and matched it to the connector type, which is LC. That was the right purchase, and matching it to the fiber type was the right instinct.



Corn

He never read the manual.



Herman

He never read the manual, which is fine, because the manual is four sentences. But the question of when it's useful is a good one, and his own guess is basically correct.



Corn

His guess was in case signal quality inexplicably dropped after working with it.



Herman

It's the number one use. Contamination is the leading cause of intermittent ten gigabit links. You get a link that comes up, runs fine, then drops, then comes back. Nine times out of ten that's a dirty end face.



Corn

Give me the list. When does it earn its keep.



Herman

Before every new mating. That's the big one. Clean both the transceiver port and the cable ferrule before you plug them together. After any unexplained link drop or high error rate. After moving or re-routing cable, because pulling through conduit drags dust into the connector. When you're swapping transceivers between switches, because a dirty connector masquerades as an incompatible module and you'll spend an hour blaming the hardware. And when you're reusing stored gear, which is directly his situation. Before those Ziploc transceivers go back into service, clean the cable ends.



Corn

And the limitation.



Herman

The pen cleans the ferrule end face. It cannot fix a scratched or burned end face. It won't clean inside a recessed transceiver port as thoroughly as a cassette cleaner or a lint-free wipe with isopropyl alcohol. For transceiver ports, a one-click cleaner designed for the



Herman (continued)

port, or a cassette cleaner, is the better tool. The pen is best for cable connectors.



Corn

And one more.



Herman

Always inspect if you can. A fiber scope, even a cheap one. Cleaning without inspecting is guessing. You might be cleaning a connector that's actually scratched, in which case you're polishing a problem.



Corn

There's a thread full of people fighting SFP+ modules that only run at gigabit in one switch and ten gigabit in another.



Herman

In a lot of those cases the module was fine and the connector was dirty. Cleaning first rules out the cheap cause before you start replacing hardware.



Corn

Daniel's hundred megabit evening. Was it wasted?



Herman

Not at all. He learned that copper fails silently and fiber fails silently, but for different reasons and on different timescales. Copper tells you immediately, in the form of a number, that something is wrong. Fiber often doesn't tell you at all until it does.



Corn

Which is a strange thing to say about the more fragile-sounding medium.



Herman

It's the more precise medium, which isn't the same as fragile.



Hilbert

The lubricant matters more than the sock.



Corn

Say that again.



Hilbert

The sock's the right answer, everyone gets told the sock. What nobody tells you is the lubricant. I watched a man use the wrong one. Oil-based, because that's what was in the van and it was Friday.



Herman

And.



Hilbert

The jacket swelled. Not much. Enough. It went through the first two elbows fine and then it wouldn't take the third one. Wouldn't budge. We pulled it back out, cut the connector off, re-terminated on site, and it cost us the afternoon.



Corn

The lesson is use the right lubricant.



Hilbert

The lesson is that fiber doesn't forgive. Copper you can pull harder. You get a kink, you straighten it out, it works. Fiber you pull harder and it works fine, and then it works fine for a week, and then the temperature changes and it starts dropping packets and you're standing there with a tester that says everything's clean.



Herman

Because the damage is in the cladding, not the connection.



Hilbert

It's in the part you can't see. That's why the pen matters. Not because the pen is magic. Because the failures are invisible until they're not, and the pen is the cheapest thing you can do about that.



Corn

You can hear it, though. You mentioned the sound.



Hilbert

You can hear it. Sliding versus binding. There's a difference, and you know it after you've done it wrong once. You can't get that from a manual. You get it from hearing the difference and remembering which one was the good one.



Herman

The pull sock is still the answer.



Hilbert

The pull sock is still the answer. Just don't grab whatever's in the van.



Corn

The thing I keep coming back to is that he has everything he needs. The cable, the optics, the conduit, the pen. The only open question is whether the pull goes clean, and that comes down to three things. The bend geometry in that conduit, the lubricant, and whether he cleans the ends before he mates them.



Herman

The multimode versus single-mode argument is still live, so if he ever redoes this, that's the decision to revisit. For now, OM3 and 10GBASE-SR is more than enough for a two-room run. The pen is the right tool for the cable connectors. He should read the manual, which is four sentences, and he should inspect before he cleans if he can.



Corn

Fiber isn't better Ethernet. It's a different medium with different failure modes, different tools, and a different feel in the hand. The hundred megabit cap was a copper problem. Everything after that is learning a new set of instincts.



Herman

Thanks as always to Hilbert Flumingtop, who produces this show and who has opinions about vans.



Corn

This has been My Weird Prompts, the human-AI collaboration podcast. If you want to send us something, email us at show at my weird prompts dot com. We'll be back soon.