DOCSIS CODEWORD ERRORS
CORRECTABLE & UNCORRECTABLE

[intro music]

>> RICK: Hi. I'm Rick Yuzzi. For cable operators, codeword errors can be a key indicator of whether something is about to go wrong or that some things are really already going wrong.

>> RICK: I'm here with Scott Helms, our Vice President of Technology to talk a little bit about this.

>> RICK: Scott, why don't you describe what codeword errors are to start out with.

>> SCOTT: Sure. So a codeword error is just the manifestation of a framing error in a DOCSIS system.

>> SCOTT: What it really means is that either a downstream or an upstream transmission was damaged to the extent that it generated either a correctable or uncorrectable codeword error.

>> RICK: So, there's correctable and uncorrectable. What's the difference there?

>> SCOTT: In DOCSIS 3.0 and earlier, we used an algorithm called Forward Error Correction, or FEC, to try and recover when we have impairments. And, what this lets us do is if a codeword isn't too badly damaged there's enough information for us to fix it and that becomes a correctable codeword error.

>> SCOTT: If it's too badly damaged, and there's not enough information to recreate it, then that becomes an uncorrectable codeword error and then the CMTS or the modem, depending on which direction it is, has to retransmit that frame.
RICK: When it's correctable, is there any retransmission then?

SCOTT: No. If it's correctable what happens is there's enough data left that the receiving end can put it back together.

SCOTT: It does delay the transmission of information somewhat, so if you have a correctable codeword error, that can sometimes lead to a perceptible problem for things that are very latency sensitive like VoIP.

RICK: Right. So for something like a web page, they may not notice that.

SCOTT: Right. Yes.

RICK: For a VoIP customer, let's say it's a correctable codeword error, what kind of thing might happen?

SCOTT: It really depends on how many and how close together they occur.

SCOTT: If you're getting 1 or 2% correctable codeword errors on a consistent basis or in spikes over the course of a conversation, then yes, you're probably going to hear like a hesitation or a clicking noise in the conversation.

SCOTT: If you get even a really low percentage of uncorrectables, you'll hear gaps and clicking and lags, so it'll have a big impact on voice.

RICK: So, obviously it sounds like being able to track codeword errors can maybe give you some insight into, let's say, correctable "when things are going to get bad" and uncorrectable, "they are already bad?"

SCOTT: Yes. We spend a lot of time in the cable world worrying about things like SNR/MER, and those are really leading indicators.

SCOTT: The codewords are kind of the dividing line between I have a problem that's on the RF side that is sufficient enough to cause something that the customer can feel or experience versus I don't.

SCOTT: If I have a bad SNR, but I'm not generating any correctable or uncorrectable codeword errors, the customer has no idea. It's not really affecting their experience.

SCOTT: Whereas, if I have codeword errors, regardless of how clean and nice my RF looks, I do have a customer-affecting with that.

RICK: Having a tool obviously that can track this, I guess, especially over time, because they're intermittent I would think, right?
SCOTT: Yes. Usually they increase with usage, so the more traffic a modem or CMTS is dealing with, the more you will generate codeword errors. So, it's kind of like, you can think about a car. If you have a little bit of a balky transmission, it doesn't really matter if you're going slow, but the faster you're going the more problematic that becomes.

RICK: So, it's important for cable operators to stay on top of these?

SCOTT: Absolutely.

RICK: Ok. Now is there a difference between upstream and downstream codeword errors?

SCOTT: There's a difference in kind of how they get framed and put together, but from a customer standpoint, no they are both equally disruptive.

SCOTT: Downstream codeword errors are often harder to track down than upstream codeword errors.

SCOTT: Upstream codeword errors, commonly, but not always, are the result of problems in the home or problems with a specific node or amplifier whereas downstream problems, a lot of times, are the result of ingress on the downstream.

RICK: Ok. Now, we've done codeword errors. You've mentioned FEC and we've done that that way for a long time. What's coming? There's something different with DOCSIS 3.1?

SCOTT: Yes. In DOCSIS 3.1, we switch to a more robust form of error correction. It's called low density priority check - LDPC - and that's a big part of the reason why we get higher bit rates through in DOCSIS 3.1 for every Hz of bandwidth.

SCOTT: That allows us in part to push to the higher modulation rates that we can get to in 3.1.

SCOTT: We'll still care about codeword errors, but the system itself is more resilient because of that.
>> RICK: Great. So there you have it. Codeword errors. Really important for you to be able to keep on top of those so that you can keep on top of your cable network and make sure that it’s performing properly.

>> RICK: Thanks a lot, Scott.

>> SCOTT: Thank you