Episode Book

EPISODE #5607

BYO Modem, But Only If We Approve It

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SYNOPSIS

Bezeq, Israel's main fiber provider, does allow customers to bring their own modem — but only approved models, and only after you submit the device's serial number and wait to be provisioned. A listener named Daniel asked three sharp questions: why an ISP would want to control device security down to the model and serial number, how reliable a device-reported serial number is as an authentication signal, and whether serial number spoofing has actually been used to get around checks like this. This episode digs into what an ONT really does on a GPON network, why ISPs insist on exclusive control of hardware you own, and the crucial difference between entitlement and authentication. Along the way: TR-069 remote management, rate limiting enforced inside the modem, the Comcast customer who had to re-register a supported modem every year, and why the cable industry abandoned identifier-based access control for X.509 certificates after getting burned by modem cloning.

TRANSCRIPT



Corn

The story you hear about this is that it's a security measure. Your ISP is protecting the network. And then you look at what the check actually is, and it's a serial number you type into a web form.



Herman

A serial number you read off a sticker.



Corn

Off a sticker. And then they let you on the network. So Daniel wrote in about this, because he's on Bezeq, which is the main fiber provider here in Israel, and Bezeq does let you bring your own modem. That part is real. But only from a narrow list of approved models and vendors, and only after you submit the device's serial number and wait for them to provision it.



Herman

And Daniel's not just annoyed at the paperwork. He's asking three things. One, why would an ISP want to control device security down to the model and serial number level in the first place. Two, how reliable is a device-reported serial number as an authentication signal. And three, are there serial number spoofing vectors that have actually been targeted or exploited to get around this kind of check.



Corn

His instinct is that this is hardware-level device whitelisting, which implies integration with the vendor's database of issued serial numbers. And if that's what it is, the question is whether the whole scheme is security or just provisioning wearing a security costume.



Herman

That's the shape of it. He's not asking whether it's inconvenient. He's asking what it actually is.



Corn

So let's start with the most basic question. What is the modem actually doing in the ISP's network, and why does the ISP care who made it?



Herman

The word "modem" is doing a lot of hiding here. On a fiber connection we're really talking about an ONT, an optical network terminal, and on a GPON network it is not a media converter. It terminates the passive optical network. It handles VLAN tagging. It often runs PPPoE. It frequently handles SIP for your landline voice service. It handles IGMP for IPTV multicast. So when you plug your own device into the fiber, you're not plugging in a dumb translator. You're plugging in something that has to speak the provider's protocols correctly or nothing works.



Corn

Which means the ISP has a legitimate interest in what that box is doing.



Herman

Up to a point. And here's the provisioning flow Daniel's describing. You buy an approved ONT. You submit the serial number. The ISP checks it against the vendor's database of issued serial numbers. And only then does the device get allowed to register on the OLT, the optical line terminal at the other end, and pass traffic.



Corn

So the check is: does this device exist in our database?



Herman

Not: is this device what it claims to be. And that distinction is the spine of this whole episode. It's an entitlement check masquerading as an authentication check.



Corn

Say that again, because I want it to land.



Herman

Entitlement asks whether you're allowed. Authentication asks whether you are who you say you are. A serial number lookup answers the first question. It does nothing for the second.



Corn

So we've got three things to work through. The rationale for the ISP wanting this control, the reliability of serial numbers as identifiers, and the spoofing surface. Let's take the rationale first, because the practitioner answer is more interesting than the marketing answer.



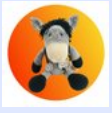
Herman

The framing I keep running into from network engineers is that even when you bring your own modem, the ISP demands exclusive control while it's in service. The customer can walk away with the hardware at the end, but they can't modify the connection settings while it's connected. It really is intended to be part of the ISP's network rather than yours.



Corn

That's a strange ownership model. You bought it. You own it. But you can't configure it.



Herman

You own the object. You don't own its behavior on their network. And the mechanism for that is TR-069, the CWMP protocol. It's how ISPs push firmware and configuration to modems and ONTs remotely. One practitioner described it bluntly as basically a backdoor the ISP uses to manage the device.



Corn

Is that unfair?



Herman

It's harsh but it's not wrong. TR-069 is a management channel that reaches into your device from outside. If the ISP can't reach the device via TR-069, it loses remote management, it loses diagnostics, it loses the ability to push firmware updates. So from their side, an unmanaged ONT is a device they can't see or fix.



Corn

And the interoperability argument?



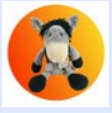
Herman

That's the public-facing one. They'll say they can't guarantee support for arbitrary hardware because each ONT is tested against their specific OLT. Every model on the approved list has been through validation against their infrastructure. Something off the list hasn't, and they won't promise it'll work.



Corn

Which is a real engineering concern. But it's also the argument that lets you justify any whitelist you want, because you control what goes on the list.



Herman

Right. And there's a sharper reason underneath it. Rate limiting. A cable installer reportedly told a customer that rate limiting is enforced in the modem itself. The device enforces the business model. And there's a documented case where users ran pirate firmware to strip out artificial speed caps, until network engineers caught on and shut down the offending connections.



Corn

So the box is the enforcement point for what you paid for.



Herman

The box is the enforcement point. Which is why the ISP wants to control the box. If you control the firmware, you control the speed cap. If the customer controls the firmware, the customer controls the speed cap. That's the whole game in one sentence.



Corn

There's also the security boundary framing. One practitioner said the ISP fiber network falls inside their security boundary, and you can't bring your own device into a security boundary. From the ISP's perspective, an unmanaged ONT sitting on the passive optical network is an unmanaged endpoint inside their trust perimeter.



Herman

That's a real architectural position. It's also convenient, because it means anything you want to keep out, you call it a security boundary issue.



Corn

Here's the counterpoint I'd raise. The ISP doesn't actually have to guarantee support to let you use your own hardware. It just has to publish the specs. Here's the PLOAM registration behavior, here's the VLAN tagging, here's the SIP profile. Go build something that speaks it. If you can't, that's on you. That's how a lot of open protocols work.



Herman

And that's the honest version of the interoperability argument. The whitelist isn't about whether the hardware can work. It's about whether the ISP wants to be on the hook when it doesn't. Support cost, telemetry, firmware control, rate limiting. Those are the real drivers. Security is the story that gets told publicly.



Corn

So the whitelist is at least as much about support cost and control as it is about genuine security.



Herman

At least as much. And there's one more layer, which is the friction itself. The multi-step serial number submission process. Is that a security feature or is it a bring-your-own-modem deterrent?



Corn

Those look identical from the outside.



Herman

They do. And the Comcast parallel is instructive. A customer had a modem on the supported list, and support insisted it wasn't. Service got killed roughly annually and required a phone call to re-register each time. And the customer's conclusion was that more and more, ISPs are trying to make it harder to bring your own modem, which feels like a cash grab.



Corn

Annual re-registration of a device that never changed.



Herman

That's not a security control. That's a speed bump with a phone number attached.



Corn

So the ISP has real operational reasons for control. Firmware, diagnostics, rate limiting, support cost. But that doesn't tell us whether the specific mechanism, serial number whitelisting, actually works as security. That's Daniel's second and third questions.



Herman

And the answer starts with a definition. A serial number is an identifier, not a credential. It's a string the device reports about itself. Nothing about the number proves the device is genuine or authorized. Without a cryptographic binding, a private key in a secure element, a signed certificate, a hardware root of trust, the serial number is just a claim.



Corn

A claim that anyone can make.



Herman

Anyone can make. The whitelist model is a database lookup. The ISP maintains a list of approved vendor serial numbers. You submit yours. They check it against the vendor's issued-serial database. If it matches, you get provisioned. That's entitlement. It answers whether the device exists in their records. It doesn't answer whether the device presenting that number is the genuine article.



Corn

So how reliable is it, actually, as an authentication signal?



Herman

It depends entirely on the integrity of the vendor's issuance database. If the vendor's list of issued serial numbers is accurate and the ISP cross-references it properly, you get reasonable assurance the device exists. You get no assurance at all that the device in front of you is that device.



Corn

Which is a strange thing to build an access control on.



Herman

It's a strange thing to build access control on. And we know it's strange because the cable industry already solved this problem, and solved it the other way. DOCSIS cable modems use X.509 certificates burned into the device, plus BPI+ encryption. That's a genuine cryptographic identity. The modem proves it's the modem, not just that a modem with that number was manufactured.



Corn

Burned in at the factory.



Herman

Burned in at the factory, in a way the customer can't read out and copy. That's the difference between a credential and a label. A label you can photocopy. A private key you can't.



Corn

And GPON?



Herman

GPON ONTs are typically authenticated by the OLT via a registration ID or serial number in the PLOAM layer. That's largely a plaintext identifier unless the ISP layers on additional binding. So the security gap between serial number whitelisting and certificate-based authentication is the whole story. One is a name tag. The other is a passport with a chip in it.



Corn

And the spoofing precedent. Because Daniel's instinct is that this invites spoofing, and he's right.



Herman

He's right, and the classic case is MAC address spoofing. MAC-based access control, port security, captive portals, DHCP allowlists, all of it is trivially bypassed by cloning a known-good MAC address. Serial number whitelisting inherits the same weakness unless the number is cryptographically bound to the hardware. Which, in the GPON case, it usually isn't.



Corn

Is there a documented history of this in the modem world specifically?



Herman

There is. Cable modem cloning was a real and widespread abuse pattern. You copy a provisioned modem's identity, its MAC and related identifiers, and you get free or faster service because the network thinks you're a paying customer's device. That's precisely why DOCSIS moved to certificate-based authentication with BPI+. The industry got burned by identifier cloning and rebuilt the trust model around cryptography.



Corn

So the cable industry learned this lesson the hard way.



Herman

The cable industry learned this lesson the hard way, and the question for fiber is whether it's repeating a mistake the cable side already outgrew.



Corn

Now, the Bezeq-specific version. Is there a documented serial number cloning exploit against Bezeq or GPON generally?



Herman

I want to be careful here, because this is where I'd flag uncertainty. The pattern is well documented. Identifier-based access control gets cloned. That's MAC addresses, that's cable modems, that's a general principle. But a specific public Bezeq serial number cloning exploit, I can't point to one. The ONT serial number is transmitted in the PLOAM registration process, so if an ISP authenticates purely on ONT serial number, a cloned serial number from an approved device could in principle impersonate it. But practical exploitation requires physical access to the passive optical network and matching what the OLT expects. So it's plausible, it's the documented pattern, but I wouldn't assert a Bezeq incident without a source.



Corn

Fair. The mechanism is real, the specific incident is unconfirmed.



Herman

And there's a second angle that's arguably more interesting than cloning, which is the approved-vendor problem. If the whitelist is really a vendor and model allowlist, the attack surface shifts to firmware and vendor trust. There was a critical vulnerability in Arris routers where WiFi keys, admin passwords, SIP credentials, and TR-069 endpoint URLs with credentials were all recoverable.



Corn

TR-069 credentials.



Herman

TR-069 endpoint URLs and credentials. So compromising an approved device gives an attacker a legitimately whitelisted identity. You don't need to spoof anything. You just need to own the box that's already allowed in.



Corn

Which is a much better attack than cloning a serial number.



Herman

Much better. Why forge an identity when you can borrow a real one that's already trusted.



Corn

And the supply chain angle. Serial numbers harvested from decommissioned or returned devices.



Herman

Or from the vendor's issuance database itself. If that database leaks, the whitelist becomes forgeable wholesale. Every serial number that was ever issued becomes a valid claim. And nobody outside the vendor and the ISP can audit whether that database is accurate or secure.



Corn

So the bottom line. Serial number whitelisting raises the bar against casual substitution. It does not provide cryptographic assurance.



Herman

It raises the bar against someone plugging in a random device. It does nothing against someone who's willing to clone an identifier, and nothing against someone who compromises an approved device. It's an entitlement check dressed up as security. The robust design is a hardware root of trust, secure element, signed certificate, secure boot. That's exactly what DOCSIS does and what bare serial number whitelisting does not.



Corn

The database was the authority, not the device.



Hilbert

The database was always the authority. That was the whole point of it. I did a stint doing field installs for a small regional fiber outfit, and provisioning ONTs was part of the job.



Corn

How long a stint?



Hilbert

Long enough to memorize the serial number format. We'd get a pallet of ONTs, and every one of them had a label, and every label had a number, and we'd type those numbers into a spreadsheet that went to the office. The office sent them to the vendor. The vendor sent back a list of which ones were valid. That was the security check.



Herman

So the vendor's issued-serial database was the gate.



Hilbert

It was an inventory reconciliation. The vendor billed per activated device. So the office needed to know which serial numbers we'd actually put on customer premises, because that's what the vendor invoiced against. The serial number submission wasn't about security at all in our shop. It was about counting.



Corn

Counting what they owed.



Hilbert

Counting what they owed, and counting what we'd received. If a box went missing off the pallet, the serial number never got activated, and the office wanted to know why. That's what the process was for.



Herman

And the security framing?



Hilbert

Came later. From marketing. When customers started asking why they couldn't use their own gear, somebody needed a reason, and "we can't verify the device" sounds better than "we can't bill for it."



Corn

So the security story is a post-hoc justification.



Hilbert

It's a post-hoc justification. And here's the thing nobody tells customers. The serial number on the box and the serial number the ONT reports over the PLOAM layer can diverge. If the device was reflashed or refurbished, the reported number and the label don't have to match. We had a stack of approved ONTs whose reported serial numbers didn't match the labels. We provisioned them anyway, because the database said the serial number was valid.



Herman

So the database said yes and the physical device was irrelevant.



Hilbert

The physical device was irrelevant. If the database said the serial number was issued, the device got service. Nobody was comparing the label to the report. Nobody had a way to.



Corn

That's the entitlement-versus-authentication distinction made concrete from the inside.



Hilbert

I don't know what that means, but the database was the authority. The device just had to say the right number.



Herman

The shop was fine with that, because the shop's job was to get service working and get the invoice right.



Hilbert

The shop's job was to get service working and get the invoice right. We were good at it, too. I could provision an ONT in under four minutes once the numbers came back. The trick was doing the splice first so the light was already there when you powered the box up. Most of the new guys would power up first and stand around waiting.



Corn

Four minutes.



Hilbert

I still have the manual somewhere. The wiring diagram page is folded over at the corner. I kept the paperwork when the outfit got bought out. The boxes went back to the vendor. The paper I kept.



Herman

The paper was the only record of the serial numbers.



Hilbert

The paper was the only record. Once the vendor's database got updated, the paper was just paper. But that's the thing about the database. It's somebody else's list. You can't see it. You can't check it. You just hope it's right.



Corn

The database was the authority, not the device.



Hilbert

The device was just the thing that said the number. The database decided whether the number was real. That's all it ever was.



Herman

That's the whole episode in one sentence.



Corn

That's the whole episode in one sentence.



Herman

It really is. And it reframes the closing question. If the serial number whitelist is really an inventory and billing reconciliation mechanism wearing a security costume, then what would a secure bring-your-own-modem regime even look like?



Corn

Would any ISP actually adopt it, given that the friction is doing useful work for them?



Herman

That's the part I keep turning over. A real security regime would look like DOCSIS. Certificate burned into the hardware, cryptographic handshake, no database lookup required for the identity check. The device proves itself. But that costs money, it requires the vendors to build it in, and it removes the ISP's ability to gate service on a phone call.



Corn

The friction isn't a bug. It's load-bearing.



Herman

The friction is load-bearing. Which means the industry either converges on certificate-based authentication, the DOCSIS path, or it keeps serial number whitelisting and inherits the spoofing surface the cable industry already outgrew. That's a policy choice, not a technical limit. The technology exists. Somebody has to decide to use it.



Corn

The serial number on the box is a claim, not a proof. The database that validates it is only as trustworthy as the vendor that maintains it.



Herman

Which is the part that should worry people. The whole scheme rests on a database nobody outside the vendor and the ISP can audit. You're trusting a list you can't see to answer a question you can't verify.



Corn

Thanks to Hilbert Flumingtop for producing.



Herman

This has been My Weird Prompts. If you want to send us something, email us at show at my weird prompts dot com.



Corn

We'll be back soon.