EPISODE #234

Deep Shelter Data: Building Emergency Mesh Networks

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EPISODE SYNOPSIS

When an emergency forces you into a deep underground shelter, the very walls designed to protect you also act as a Faraday cage, cutting off all cellular and Wi-Fi signals. In this episode, Herman and Corn explore the technical challenges of maintaining connectivity in reinforced concrete environments and provide a blueprint for building a DIY "data bridge." From the portability of the Starlink Mini to the flexibility of OpenWRT travel routers, discover how to assemble a resilient communications kit that keeps you connected to the world above when it matters most.

DANIEL'S PROMPT

Daniel

In deep underground shelters, cellular networks often fail to penetrate. While some shelters provide Ethernet ports, most people lack the necessary equipment to use them. Could a battery-powered mesh network, with nodes placed on each floor starting from the entrance, be used to bring a viable internet connection underground during an emergency? Does this technology currently exist for emergency preparedness, and what specific gear would be needed to set it up?

TRANSCRIPT

Corn

Hey everyone, welcome back to My Weird Prompts. I am Corn, and I am sitting here in our living room in Jerusalem, looking out at a surprisingly clear sky today.

Herman

And I am Herman Poppleberry. It is a beautiful day, Corn, but as our housemate Daniel reminded us in that voice note, the peace and quiet can feel a bit fragile sometimes. He has been thinking a lot about digital preparedness lately, specifically what happens when you have to head underground.

Corn

Yeah, Daniel really tapped into a universal anxiety for anyone living in a modern city with deep shelters. You go down five or six flights of stairs, the concrete walls are three feet thick, and suddenly your phone is just a very expensive paperweight. No bars, no data, no connection to the world above.

Herman

It is a literal Faraday cage. Those shelters are designed to keep things out, but unfortunately, that includes the radio waves we rely on for everything from news updates to checking in with family. Daniel was asking if a battery-powered mesh network could be the answer, essentially leap-frogging the internet from the surface down into the depths.

Corn

It is a fascinating engineering challenge. We have touched on networking basics before, like in episode one hundred and eighty-four when we did that deep dive into the O-S-I model, but this is a very practical, high-stakes application. Can you actually build a reliable data bridge using off-the-shelf gear in the middle of an emergency?

Herman

The short answer is yes, but the long answer involves a lot of physics, some very specific hardware choices, and an understanding of how signal attenuation works in heavy construction. I have actually been looking into this since Daniel mentioned it, and the technology has evolved quite a bit in the last couple of years.

Corn

Well, before we get into the gear, let's talk about the problem. Why exactly does the signal die so fast? I mean, I can get Wi-Fi through a couple of walls in my house, but the moment I step into that stairwell leading to the shelter, it is gone.

Herman

It comes down to frequency and material density. Most cellular signals and standard Wi-Fi operate at high frequencies, like two point four gigahertz or five gigahertz. These waves are great for carrying a lot of data, but they are terrible at penetrating dense materials. Reinforced concrete is the ultimate enemy here because it is not just rock; it is rock filled with a grid of steel rebar.

Corn

Right, the rebar acts like a mesh itself, scattering and absorbing the signal.

Herman

Exactly. It is like trying to shine a flashlight through a thick wool blanket. By the time the wave gets through one floor of a parking garage or a shelter, it has lost ninety percent of its strength. By the third floor, it is effectively noise. This is why Daniel's idea of a mesh network is so intuitive. Instead of trying to blast a signal through the ceiling, you are essentially creating a bucket brigade of data along the path of least resistance.

Corn

So, instead of one big antenna on the roof, you are placing small nodes at every turn of the stairs or on every landing.

Herman

Precisely. You are keeping the distance between nodes short enough that they can talk to each other through the air in the stairwell or through just one wall at a time. Each node receives the data, refreshes the signal, and passes it to the next one.

Corn

Okay, so let's look at the "input" side of this. If the goal is to bring the internet underground, you need an internet source at the entrance that actually works when the local cell towers might be overloaded or down.

Herman

This is where things have changed recently. For a long time, you were stuck relying on a local cell signal at the door, which is risky in a real emergency. But back in mid-twenty-twenty-four, SpaceX released the Starlink Mini. I know we mentioned it briefly in a past episode, but for this specific scenario, it is a game-changer. It is about the size of a laptop, it can run off a standard U-S-B-C power bank, and it gives you a direct link to a satellite constellation.

Corn

So you set the Starlink Mini up just outside the entrance, or maybe in a window with a clear view of the sky, and that becomes your "gateway" node.

Herman

Right. That provides the initial high-speed backhaul. But then you have the challenge of getting that signal down the stairs. You wouldn't want to use another Starlink dish for that, obviously. You need something small, portable, and battery-efficient.

Corn

I'm assuming we are looking at those travel routers you are always obsessing over?

Herman

You know me too well. Specifically, the gear from G-L-i-Net has become the gold standard for this kind of DIY mesh setup. They have models like the Beryl A-X or the Slate A-X. These are small, pocket-sized routers that run on Open-W-R-T, which is an open-source operating system for routers.

Corn

What makes them better than, say, just a bunch of old home routers I have in the closet?

Herman

Power and flexibility. Those G-L-i-Net routers can be powered by the same U-S-B power banks you use for your phone. In an emergency, you don't have wall outlets. You need something that can run for twelve or twenty-four hours on a battery. Plus, they support W-D-S, which stands for Wireless Distribution System. That is the protocol that allows them to mesh together wirelessly without needing Ethernet cables between them.

Corn

So, if Daniel wanted to set this up, he would have a Starlink Mini at the surface, connected via a short Ethernet cable to his first G-L-i-Net router. Then, he drops a second router one flight down, a third router another flight down, and so on.

Herman

Exactly. And because these are Wi-Fi six devices, they have much better range and congestion management than the older tech. Even though we are seeing Wi-Fi seven gear hit the market now in early twenty-twenty-six, for an emergency mesh, Wi-Fi six is the sweet spot because the hardware is affordable and the battery draw is very predictable.

Corn

I'm curious about the latency though. Daniel mentioned this in his note. Every time you "hop" from one node to another, doesn't that slow things down?

Herman

It does. Every wireless hop typically cuts your potential bandwidth in half and adds a few milliseconds of delay. If you have five hops to get to the bottom of a deep shelter, you aren't going to be gaming or editing high-definition video. But for what Daniel is talking about, checking the news, receiving official instructions, or sending a text to a loved one, it is more than enough. You might go from three hundred megabits at the surface to maybe ten or fifteen megabits at the bottom, but ten megabits in a bunker feels like a miracle when everyone else has zero.

Corn

That is a great point. It is the difference between total isolation and a functional connection. But how do you actually manage the "placement" of these nodes? If I'm in a rush, I'm not exactly going to be doing a site survey with professional tools.

Herman

That is the beauty of the mesh. Most of these modern travel routers have a simple L-E-D indicator or a phone app that shows the signal strength between nodes. You just walk down the stairs until the light turns from green to yellow, then you back up a few steps and place the node there. You can use heavy-duty mounting tape or even just set them on a ledge.

Corn

It sounds like something that requires a bit of a "kit" prepared in advance. You can't just wing this with one router.

Herman

Definitely not. If you are serious about this, you need a dedicated "Go-Bag" for your network. I actually put one together after we talked about logistics and resilience back in episode two hundred and thirty. My kit has three G-L-i-Net Slate A-X routers, three twenty-thousand milliamp-hour batteries, and a bunch of flat Ethernet cables just in case the wireless mesh gets too much interference.

Corn

Flat cables are smart. You can run them under doors or through tight gaps without pinching the wires.

Herman

Precisely. And if you have those cables, you can eliminate that "half-bandwidth" penalty I mentioned earlier. If you can run a cable between two nodes, the mesh becomes incredibly stable.

Corn

Let's talk about the software side for a second. If you are setting up a public mesh in a shelter full of people, security has to be an issue. You don't want someone on floor three snooping on what someone on floor five is doing.

Herman

That is one of the big risks. In an emergency, people get desperate for information, and a "rogue" node could easily be set up to perform a man-in-the-middle attack. This is where the Open-W-R-T firmware is so valuable. You can set up an encrypted bridge using WireGuard. We talked about encryption in the B-G-P hijacking episode, number two hundred and thirty-one, and the same principles apply here. You want to make sure the "tunnel" from the bottom of the shelter to the Starlink at the top is encrypted so that even if someone intercepts the wireless signal in the stairwell, they can't read the data.

Corn

That makes sense. But there is also a social aspect to this. If you bring the internet to a shelter where two hundred people are hiding, and they all see a Wi-Fi network called "Emergency Internet," they are all going to jump on it. Your ten-megabit connection is going to collapse instantly.

Herman

That is a very real problem. If two hundred phones start trying to sync their cloud photos and update their apps the moment they hit the Wi-Fi, the network will die. If you are the one running the mesh, you have to be the administrator. You would need to set up what is called "Quality of Service" or Q-o-S rules. You basically tell the router to prioritize tiny packets of data, like text messages and news headlines, and block or heavily throttle big things like video streaming or app updates.

Corn

I can imagine that being a bit of a tense situation. "Sorry everyone, no TikTok in the bunker, we need the bandwidth for the Home Front Command updates."

Herman

It sounds funny, but in a high-stress environment, having a "digital gatekeeper" is actually a service to the community. You are preserving a scarce resource. You could even set a "captive portal," you know, like those splash pages you see at hotels, that says, "This is an emergency network. Please use text only."

Corn

That is a really practical takeaway. Now, Daniel also asked if this technology exists specifically for emergency preparedness. Are there companies selling "Bunker Wi-Fi" kits?

Herman

There are, but they are mostly targeted at the industrial and mining sectors. Companies like Rajant or Silvus Technologies make "kinetic mesh" systems that are incredibly rugged. They are used in underground mines and by military units. They can handle massive interference and have "self-healing" capabilities, meaning if one node gets crushed or loses power, the others automatically find a new path.

Corn

I'm guessing those aren't exactly budget-friendly for the average person living in an apartment.

Herman

Not at all. A single node from those companies can cost thousands of dollars. For someone like us, or for Daniel, the "Prosumer" route is much more realistic. Combining a Starlink for the source with a handful of high-end travel routers gives you about eighty percent of the performance of those military systems at five percent of the cost.

Corn

It is interesting how the consumer market has caught up. I remember when "mesh" was this exotic thing that only enterprise offices had. Now you can buy a three-pack of nodes at a big-box store for two hundred dollars.

Herman

True, but those home mesh systems like Eero or Nest are often too "dumb" for this. They really want to be plugged into a wall and managed by a cloud server. If they lose their connection to the internet, sometimes you can't even log into the local settings to fix them. That is why I keep pushing the Open-W-R-T gear. It works entirely offline. You are the master of the hardware.

Corn

Okay, so we have talked about Wi-Fi based mesh, but what about other types of emergency networks? I've seen things like GoTenna or these LoRa based systems. How do they fit into the underground shelter scenario?

Herman

That is a great alternative if you don't need "the internet" specifically, but just need to communicate. LoRa stands for Long Range. It is a low-power, low-bandwidth radio technology. There is a huge open-source project called Meshtastic that uses LoRa.

Corn

I've heard of that. People use it for hiking and off-grid communication, right?

Herman

Exactly. Each device is about the size of a deck of cards and has a little antenna. They don't send photos or video, it is purely for text messages and G-P-S coordinates. But here is the kicker, LoRa is much better at penetrating obstacles than Wi-Fi. It operates at much lower frequencies, usually around nine hundred and fifteen megahertz in the United States or eight hundred and sixty-eight megahertz in Europe and Israel.

Corn

So it might actually make it through a floor or two of concrete without needing a node in the middle?

Herman

Exactly. In my testing, a Meshtastic node can often punch through two or three floors of a parking garage where Wi-Fi would give up after one. If your goal is just to stay in touch with the people in the shelter or send a "we are safe" message to someone at the surface, a LoRa mesh is actually more reliable and the batteries last for days, not hours.

Corn

So maybe the ultimate setup is a hybrid? You have the Wi-Fi mesh for when you need to check the news and the LoRa mesh as the "fail-safe" for basic coordination.

Herman

That is the "belt and braces" approach. If I were designing a dream setup for our building, that is exactly what I would do. I would have a Meshtastic node permanently mounted in the shelter and one in our apartment. Even if the power goes out and the Wi-Fi mesh fails, those little LoRa nodes will keep chirping away on their internal batteries.

Corn

It is funny how we have moved from "the internet is a luxury" to "the internet is a critical utility," especially in these moments of crisis. It reminds me of our conversation in episode two hundred and twenty-nine about the rental market and how the law often fails to keep up with basic needs. Having a connection isn't just about entertainment; it is about safety and mental health.

Herman

Absolutely. The psychological impact of being "in the dark" is huge. When you can see a map, read an official update, or just see a "thumbs up" emoji from a friend, your heart rate drops. It turns an emergency into a manageable situation.

Corn

So, if we were to give Daniel a shopping list for his "Bunker Mesh Kit," what are the essentials?

Herman

Okay, number one, a Starlink Mini. It is the only reliable way to get high-speed data if the local ground infrastructure is compromised. Number two, at least three G-L-i-Net Slate A-X routers. They are small, powerful, and run on U-S-B. Number three, three large power banks, at least twenty-thousand milliamp-hours each, with U-S-B-C Power Delivery.

Corn

And don't forget the cables.

Herman

Right, a handful of ten-foot flat Ethernet cables. And finally, I would add two Meshtastic nodes, like the Heltec Vision Master or the Lily-go T-Beam. They are cheap, maybe thirty or forty dollars each, and they provide that low-bandwidth lifeline that won't quit.

Corn

It sounds like a lot of gear, but when you think about it, it all fits into a single backpack.

Herman

It does. And you don't just use it for emergencies. I take those travel routers every time we go on a trip. They are great for staying secure on hotel Wi-Fi.

Corn

True. I remember you setting that up when we went to that tech conference last year. It was nice having our own little private bubble of internet in the middle of a crowded lobby.

Herman

See? Practical and prepared. That is the Poppleberry way.

Corn

Speaking of being prepared, one thing we haven't touched on is the "legal" side of this. If you are setting up a Starlink and a mesh network in a public space, do you run into any issues with local regulations?

Herman

In a declared emergency, those rules usually go out the window. Authorities are generally happy if citizens are finding ways to stay informed and calm. However, you should always be aware of where you are placing your gear. You don't want to block emergency exits or interfere with the actual first responders' radio frequencies. Most of the gear we are talking about operates in "unlicensed" bands, so it is perfectly legal to use, but you have to be respectful of the physical space.

Corn

That is a good point. You don't want your "emergency kit" to become a tripping hazard for people rushing into the shelter.

Herman

Exactly. Use that mounting tape I mentioned. Keep the cables tucked against the corners of the stairs. Be a good digital citizen.

Corn

I think what I love most about this topic is how it empowers the individual. We often feel so helpless when big systems fail, whether it is the power grid or the cell network. But with a little bit of knowledge and a few hundred dollars worth of gear, you can actually build your own infrastructure.

Herman

It is the ultimate "My Weird Prompts" topic. It combines technical nerdery with real-world survival. And honestly, it is a great project for a weekend. You don't have to wait for an emergency to test this. Go to a local multi-story parking garage on a quiet Sunday and see if you can get a signal from the roof to the basement. It is a fun way to learn about networking.

Corn

I can see the headline now: "Two Brothers Found Skulking in Parking Garage with Laptops and Batteries. Claim it is for a Podcast."

Herman

Hey, if it works, it works! And I guarantee you, the moment someone else in that garage sees they have five bars of Wi-Fi in the basement, they are going to think we are geniuses.

Corn

Or wizards. Possibly both. You know, it is interesting to think about how this might evolve in the next few years. We are already seeing "Direct-to-Cell" satellite technology being tested. Companies like T-Mobile and SpaceX are working on ways for your standard phone to talk directly to a satellite for emergency texts.

Herman

That is the "holy grail," but the physics are still tough. Those signals are very weak because they are coming from hundreds of miles away. They will work great if you are standing in an open field, but they still won't penetrate six floors of concrete. So even in the future, the "mesh" approach, getting the signal to the door and then relaying it inside, is still going to be the most reliable method for deep shelters.

Corn

So Daniel's idea isn't just a "workaround" for today; it is likely going to be the standard operating procedure for a long time.

Herman

I think so. The "last mile" of connectivity is often the hardest, but in this case, the "last fifty yards" is the real challenge.

Corn

Well, I think we have given Daniel a lot to chew on. It is a brilliant question, and it really highlights how much the landscape of "preparedness" has shifted from just having extra water and batteries to having a plan for your data.

Herman

It is the twenty-first-century survival kit. Water, food, first aid, and a mesh network.

Corn

I might have to add a few of those G-L-i-Net routers to my own kit now. You have convinced me, Herman.

Herman

My work here is done. But seriously, if anyone listening has actually deployed a mesh like this in a real-world situation, we would love to hear about it. What worked? What failed? Did the concrete win, or did the data get through?

Corn

Yeah, reach out to us. You can find the contact form on our website at myweirdprompts.com. We love getting these kinds of boots-on-the-ground reports.

Herman

And if you've been listening to us for a while and you find these deep dives helpful, please take a second to leave us a review on your podcast app or on Spotify. It really does help other curious minds find the show.

Corn

It really does. We have been doing this for over two hundred episodes now, and the community of listeners we have built is just incredible. Thanks for being part of it.

Herman

This has been My Weird Prompts. I'm Herman Poppleberry.

Corn

And I'm Corn. Thanks to Daniel for the prompt, and thanks to all of you for listening. We will catch you in the next one.

Herman

Stay connected, stay safe, and keep asking those weird questions.

Corn

Take care, everyone.

Herman

Bye for now.

Corn

So, Herman, are we actually going to go to that parking garage this Sunday?

Herman

I already have the batteries charging, Corn. You bring the snacks, I'll bring the Slate A-X.

Corn

Deal. But if the security guard asks what we are doing, you're the one explaining the O-S-I model to him.

Herman

I'll start with Layer One, the Physical Layer. He'll be asleep in five minutes.

Corn

Perfect. Alright, let's get out of here.

Herman

See you on the website, everyone. My-weird-prompts dot com. Check out the R-S-S feed while you're there.

Corn

Peace.

Herman

And out.