

MY WEIRD PROMPTS

Podcast Transcript

EPISODE #389

Breaking the Monolith: Building a Resilient Home Lab Grid

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EPISODE SYNOPSIS

In this episode, Herman and Corn dive into the "single point of failure" problem after a hardware collapse leaves a friend's smart home in the dark. They explore the shift from consolidated, beefy desktops to distributed hardware grids using Raspberry Pis, Turing Pi clusters, and "Tiny-Mini-Micro" PCs. By shrinking the "blast radius" of hardware failures, home labbers can ensure their smart homes stay functional even when a component dies. But is the added complexity of managing a cluster worth the peace of mind? Tune in to learn about High Availability, PoE setups, and why your home infrastructure might need to look more like a grid than a monolith.

DANIEL'S PROMPT

Daniel

After experiencing a home server failure, I've been considering moving away from hosting multiple services on a single machine to minimize the impact of hardware failure. I'm thinking about running each service, like Home Assistant, on its own small, inexpensive computer like a Raspberry Pi. Are you aware of any hardware or projects that facilitate creating a stack or grid of mini-computers for hardware-level separation, and what do you think of this as a concept?

TRANSCRIPT

Corn

So, Herman, I was walking through the hallway earlier and I noticed Daniel staring intensely at that old desktop he uses for the home server. It had that specific look of a machine that had just given up on life.

Herman

Yeah, I saw the same thing. It is a sad sight when a trusty old rig finally breathes its last. Daniel was telling me that it is likely the power supply unit that went, which is usually the best-case scenario for a hardware failure because it rarely kills the data, but it really highlights the massive downside of the way many of us set up our home labs.

Corn

Right, he sent us this prompt because he is basically living through a minor technological catastrophe in our house right now. He has Home Assistant, his home inventory system, and a bunch of other virtual machines all running on that one box. When the power supply died, the whole house basically went back to the nineteen fifties. No smart lights, no inventory tracking, nothing.

Herman

It is the classic single point of failure problem. We talk about the cloud being someone else's computer, but when you host everything at home on one machine, you are essentially creating your own private cloud with a very fragile foundation. Daniel is asking a really interesting question here: should we be moving away from that big, beefy, consolidated server and instead moving toward a distributed grid of smaller, independent machines?

Corn

It is a complete reversal of the trend we have seen over the last decade. Everything has been about virtualization and containerization, putting as much as possible onto one powerful C P U to save on space and power. But Daniel is suggesting a hardware-level separation. If Home Assistant is on its own Raspberry Pi, and the file server is on another, and the tunnel is on a third, then one power supply failure only takes down one service.

Herman

Exactly. It is about minimizing the blast radius. If your home inventory system goes down, it is an annoyance. If your smart home controller goes down and you cannot turn on the kitchen lights because there is no physical switch, that is a crisis.

Corn

So, Herman, you are the one who is always reading about these niche hardware projects. Are there actually systems designed for this? I mean, I have seen people with stacks of Raspberry Pis held together with rubber bands and acrylic spacers, but is there a more professional way to build a grid like this?

Herman

There absolutely is, and it is a fascinating corner of the hardware world right now. The most prominent project that comes to mind is the Turing Pi two. Have you seen that one?

Corn

I have heard the name, but I am not entirely clear on how it works. Is it just a rack for Pis?

Herman

It is much more than just a rack. It is a mini I T X cluster board. Basically, it is one large motherboard that has four slots on it. But instead of plugging in a standard processor, you plug in what are called Compute Modules. These can be Raspberry Pi Compute Module four units, or even more powerful ones like the Turing R K one, which has an eight-core processor and up to thirty-two gigabytes of R A M.

Corn

Okay, so it is one board, but four independent computers? How does that solve the power supply issue Daniel is worried about?

Herman

Well, that is the catch. It uses a single power supply to feed all four modules. So, if the power supply on the Turing Pi board dies, you are still in the same boat as Daniel. However, it solves the other half of the problem, which is software and local hardware isolation. Each of those four modules is its own independent system with its own memory and its own storage. If one module has a kernel panic or a storage failure, the other three keep humming along perfectly.

Corn

That is an improvement, but I think Daniel is looking for even more separation. He mentioned running each service on its own small, inexpensive computer. If he literally bought four separate Raspberry Pi five units and gave each one its own power brick, that would be the ultimate hardware-level separation, right?

Herman

It would, but then you run into a different kind of nightmare: the cable spaghetti. Imagine four power cables, four ethernet cables, and four S D cards or tiny solid state drives. It becomes a massive physical mess very quickly. That is why people are moving toward P o E, or Power over Ethernet. You use one specialized switch to send power and data over a single cable to each Pi. It cleans up the mess, but you are still managing multiple physical boxes.

Corn

I see. So, what about the networking side of this? If you have four separate computers, you need a switch to connect them all so they can talk to each other and the rest of the house. Does something like the Turing Pi handle that?

Herman

It does. It has an integrated gigabit switch on the board itself. But if Daniel wants to go the individual route, he should look at two point five gigabit ethernet switches, which are becoming the standard for home labs in twenty twenty-six. It gives you much more breathing room for moving large files between nodes.

Corn

This makes me wonder about the trade-offs of power consumption. One big old desktop, like the one that just died on Daniel, probably pulls a lot of power even when it is idling. How does that compare to a stack of four or five Raspberry Pis?

Herman

That is where the math gets really interesting. An old desktop might idle at sixty or seventy watts. A Raspberry Pi five idles at maybe three to five watts. Even if you have five of them, you are looking at twenty-five watts total. Over a year, that is a significant difference in your electricity bill, and it generates way less heat.

Corn

So it is more efficient, more resilient to individual component failure, and quieter. What is the catch? Why isn't everyone doing this?

Herman

I think the catch is the management overhead. When you have one big Proxmox server, you have one interface to manage everything. You can take snapshots of your virtual machines, you can move resources around easily, and you have a single place to check for updates. When you have five separate physical machines, you have five operating systems to maintain. You have five sets of security updates to run. It is five times the administrative work unless you are using automation tools like Ansible or Terraform.

Corn

That is a great point. I can see Daniel getting frustrated if he has to log into five different terminals just to keep the house running. But, let's look at the reliability of the storage. One of the biggest complaints about Raspberry Pis over the years has been the reliability of micro S D cards. If Daniel moves to a grid of Pis, isn't he just trading a power supply risk for a high risk of storage failure?

Herman

He would be if he stuck with S D cards. But the newer hardware, like the Raspberry Pi five or the Compute Module four, supports N V M e storage through P C I e extensions. There are boards now, like the Zimaboard or the newer ZimaCube, that are designed specifically to be small, low-power servers with reliable storage interfaces built-in.

Corn

I am glad you mentioned the Zimaboard. I have been seeing those pop up in a lot of home lab forums lately. They look like a giant heat sink with some ports on the side. What makes them different from a standard single board computer like a Pi?

Herman

The Zimaboard is interesting because it uses an x eighty-six processor, which is the same architecture as a standard desktop. The Raspberry Pi uses A R M. For a lot of people, x eighty-six is just easier because every piece of software ever written for Linux works on it without needing a special version. The Zimaboard also has built-in S A T A ports and a P C I e slot, which makes it much easier to attach real hard drives or high-speed networking cards.

Corn

So, if Daniel wanted to follow through on this grid idea, he could essentially have a row of Zimaboards on a shelf. One for Home Assistant, one for his cloud tunnel, one for his inventory. It would be a bit more expensive than Pis, but the hardware would be more robust.

Herman

Exactly. And there is a newer version called the ZimaBlade that is even more modular. But I want to go back to the conceptual level for a second. Daniel's frustration comes from the smart home failing. In the industry, we call this the blast radius of a failure. If your home server is a single point of failure, the blast radius is your entire life.

Corn

I like that term. So, by moving to a grid, he is effectively shrinking the blast radius of any single hardware failure to just one specific function.

Herman

Right. But there is a middle ground that I think is even more robust, though it requires more technical setup. It is called High Availability, or H A. Instead of having one service per machine, you have a cluster of three machines that all work together. If any one of those three machines dies—whether it is the power supply, the C P U, or the storage—the other two realize it immediately and take over the workload.

Corn

Now we are getting into professional data center territory. Can you actually run a high availability cluster on small, inexpensive computers at home?

Herman

You can! People do this with something called K three S, which is a lightweight version of Kubernetes. You can have a cluster of three Raspberry Pis, and if you pull the power plug on one of them, your Home Assistant instance just migrates to another Pi in the cluster and keeps running.

Corn

That sounds like the ultimate solution for Daniel. It addresses his fear of hardware failure without forcing him to manually manage five separate silos. But, how hard is that to set up? I mean, Daniel is tech-savvy, but he also has a life. Is he going to spend every weekend debugging a Kubernetes cluster just so he can turn his lights on?

Herman

That is the million-dollar question. There is a very real danger of over-engineering your home. You start with a simple goal—make the lights turn on automatically—and you end up managing a distributed container orchestration system that would make a Google engineer sweat.

Corn

I think there is a psychological component to this too. When everything is on one machine, you feel like you have a handle on it. When it is a grid or a cluster, it starts to feel like a living organism that you might lose control over.

Herman

That is a fair point. But think about the alternative. Daniel is currently sitting in a house where the technology has failed him. The simple solution of one big server proved to be a fragile solution. I think the grid concept is actually more aligned with how we should think about home infrastructure. We don't have one giant light bulb in the middle of the house that lights every room; we have individual bulbs. If one burns out, the rest of the house isn't dark.

Corn

That is a perfect analogy, Herman. So, let's talk about some other hardware that fits this grid model. I have seen people using these tiny, one-liter P Cs from companies like Dell, H P, and Lenovo. They call them Project Tiny-Mini-Micro in the home lab community. How do those fit into this?

Herman

Oh, I love those. They are essentially the middle ground between a Raspberry Pi and a full desktop. You can find them used on eBay for a hundred to a hundred and fifty dollars. They are incredibly reliable, they use standard laptop parts, and they are much more powerful than a Pi. If Daniel bought three of those—maybe something with an Intel N one hundred processor—he would have a phenomenally powerful and resilient grid.

Corn

And they are small enough that you can actually stack them. I have seen three-D printed racks specifically designed to hold four or five of these tiny P Cs. It looks like a little mini-mainframe.

Herman

It really does. And from a hardware separation standpoint, it is excellent. You can have one dedicated entirely to your firewall and networking, one for your home automation, and one for your media and files. If the media server's hard drive dies, your firewall is still protecting the house. That kind of isolation is something you just don't get when everything is virtualized on one box.

Corn

Let's talk about the Cloudflare tunnel part of Daniel's prompt. He mentioned he is using that to connect his home network to the outside world. If that service is running on the same machine as everything else, and that machine dies, he loses his remote access too. That seems like a prime candidate for its own dedicated hardware.

Herman

Absolutely. In fact, if I were Daniel, the very first thing I would do is move the core networking and access services to their own dedicated, low-power device. Even something as small as a Raspberry Pi Zero two W could handle a Cloudflare tunnel or a Tailscale exit node. It draws almost zero power, and you can just tuck it away near your router.

Corn

So, we have talked about the Turing Pi, the Zimaboard, and the Tiny-Mini-Micro P Cs. But what about the software side of this grid? If Daniel goes this route, how does he keep his data synchronized? If his home inventory system is on one machine, but he wants to back it up to a drive on another machine, doesn't that create a lot of network traffic?

Herman

It does, but on a modern home network with gigabit or two point five gigabit ethernet, that is not really a concern. The bigger issue is data integrity. This is where we should probably mention something like Proxmox clusters. You can actually run Proxmox on those tiny P Cs and link them together. It gives you that single interface we talked about earlier, but the actual work is spread across the physical machines.

Corn

Wait, so you can have the best of both worlds? The ease of management of a single server, but the hardware-level separation of a grid?

Herman

To an extent, yes. If you have a Proxmox cluster, you can tell the system, Always run Home Assistant on Node One, but if Node One fails, move it to Node Two. It is called high availability, and it is the gold standard for this kind of thing. The only downside is that you need a way to share the storage between the machines, which usually means a separate N A S, or Network Attached Storage.

Corn

Which brings us back to... another single point of failure! If the N A S dies, the whole cluster loses its data.

Herman

You caught me, Corn! It is the turtles all the way down problem of system administration. You can always add more redundancy, but at some point, you have to accept a certain level of risk. Or, you go even deeper and build a distributed storage system like Ceph, where the data itself is spread across all the machines in the grid.

Corn

Okay, now I know you are trying to give Daniel a headache. Ceph is famously complex to manage. I think for a home user, even a very nerdy one like our housemate, we need to find the sweet spot of reliability versus complexity.

Herman

You are right. So let's bring it back to earth. If Daniel asked me for a recommendation tomorrow, I would tell him to look at the Two Plus One strategy.

Corn

Two plus one? What is that?

Herman

You have one primary server for your heavy stuff—Plex, file storage, maybe some big data projects. This is a solid, reliable machine, maybe a refurbished tiny P C. Then, you have a second, much smaller machine—like a Raspberry Pi or a Zimaboard—that runs only your mission-critical home services. That is Home Assistant and your networking tunnel.

Corn

And the plus one?

Herman

The plus one is a cold standby. It is a pre-configured S D card or a backup of your configuration files stored in the cloud or on a thumb drive. If either of your two machines fails, you can be back up and running on a spare piece of hardware in ten minutes.

Corn

That seems much more sensible than a five-node Kubernetes cluster. It acknowledges that hardware will fail, but it focuses on a quick recovery rather than trying to build a system that never fails.

Herman

Exactly. There is a saying in the industry: Hope is not a strategy. Daniel hoped his old desktop would keep running forever. Now he knows it won't. The strategy now is to separate the fun stuff from the essential stuff.

Corn

I think about how this applies to the broader world of technology too. We have seen this massive shift toward The Cloud, which is just one giant, consolidated set of servers owned by a few companies. But now there is this movement toward Edge Computing, where the processing happens closer to where the data is—like in your house. Daniel's grid idea is basically a mini version of edge computing.

Herman

It really does. And as our homes get smarter, the stakes get higher. If my internet goes out, I shouldn't lose the ability to dim my lights. If my home server's power supply dies, I shouldn't lose the ability to see what is in my freezer. The grid model makes the home more like a biological system. If you cut your finger, your whole body doesn't stop working. The damage is localized.

Corn

That is a very Herman Poppleberry way of looking at it. Biological systems as a model for home networking. I love it. But let's get practical for a second. If someone is listening to this and they want to start building their own grid, what is the first piece of hardware they should buy?

Herman

If they want to go the A R M route and they like the idea of a clean, single-board solution, I would say look at the Turing Pi two. It is just such a cool piece of engineering. But if they want the most bang for their buck and the easiest software experience, go on a used electronics site and look for a Lenovo Tiny or a Dell Micro with an Intel eighth-generation processor or newer. They are incredible little machines.

Corn

And what about the software? Should they jump straight into Proxmox, or just run a simple Linux distribution on each one?

Herman

Start simple. Run Ubuntu Server or Debian on each one. Get comfortable with managing multiple machines. Use a tool like Portainer if you want a nice web interface to manage containers across your grid. Once you feel like you have a handle on that, then you can start looking into clustering and high availability.

Corn

I also want to mention the Home Assistant Yellow. It is a piece of hardware designed by the Home Assistant team themselves. It is basically a carrier board for a Raspberry Pi Compute Module, but it has everything built-in—Zigbee, Matter support, N V M e storage. To me, that seems like the perfect Node One for a home grid. It is purpose-built for the most important task.

Herman

I agree. It takes the guesswork out of the hardware. You know it is going to be stable, and you know it has the right radios to talk to your devices. Then you can use your other nodes in the grid for the more experimental stuff.

Corn

You know, talking about this makes me realize how much our relationship with technology has changed. Ten years ago, having a server in your house was a very niche hobby. Now, with smart homes being so common, it is almost becoming a necessity for anyone who wants privacy and control.

Herman

It is true. But the industry hasn't quite caught up with the need for consumer-grade reliability in these setups. We are still in the era of tinkerers. That is why Daniel is having to think about power supplies and hardware grids instead of just buying a home brain that works forever.

Corn

Maybe that is the future, though. A grid-in-a-box where you just slide in modules like Lego bricks. If one light on the front turns red, you pull that brick out and slide a new one in, and the system automatically heals itself.

Herman

That is the dream, Corn. And honestly, we are not that far off. Projects like the Turing Pi are the first steps toward that. They are making the hardware more modular and less intimidating.

Corn

I am curious, Herman, if you were building a grid from scratch today, with no budget constraints—well, let's say a reasonable nerd budget—what would your grid look like?

Herman

Oh, man. You are speaking my love language now. Okay, I would start with three of those ZimaBlades. I would use one as a dedicated router and firewall running O P N sense. The second one would be my Home Core, running Home Assistant and my local D N S. The third one would be my Media and Lab node for everything else. And I would have them all connected to a small, managed switch with a single, high-quality uninterruptible power supply, or U P S.

Corn

A U P S is something we haven't mentioned yet, but it is probably the most important part of the grid. It protects against the external power failure.

Herman

Exactly. A U P S gives your grid time to shut down gracefully if the power goes out, or it keeps it running through short brownouts. For a small grid of low-power machines, a standard consumer U P S could keep the whole thing running for an hour or more.

Corn

That sounds like a solid plan. I think Daniel would be much happier with that setup. He would have the physical separation he wants, the power efficiency of small nodes, and a clear path for recovery if something breaks.

Herman

And he wouldn't be standing in the dark staring at a dead desktop.

Corn

Right! That is the most important part. So, I think we have covered the what and the how of the grid concept. But what about the why in a larger sense? Do you think this move toward decentralization in the home is part of a bigger trend?

Herman

I do. I think people are becoming more aware of the risks of centralization. We have seen it with social media, we have seen it with cloud services going offline, and now we are seeing it at the household level. There is a growing desire for digital sovereignty. People want to own their data and their infrastructure. Building a resilient home grid is the ultimate expression of that.

Corn

Digital sovereignty. I like that. It sounds much more impressive than I have a bunch of Pis in my closet.

Herman

It does, doesn't it? But at the end of the day, it is the same thing. It is about taking responsibility for your own tech. It is more work, sure, but the peace of mind you get when you know exactly how your house works—and that it is built to survive a failure—is worth it.

Corn

I think about the people who aren't tech-savvy, though. They are just going to buy whatever hub Amazon or Google sells them. They are trading that sovereignty for convenience. And when those services fail, they are truly helpless.

Herman

That is the tragedy of the modern smart home. We have traded resilience for ease of use. But for people like Daniel, and hopefully for our listeners, there is a middle path. You can have the convenience of a smart home without the fragility of a centralized cloud. It just takes a bit of planning and a few small, inexpensive computers.

Corn

Well, I think we have given Daniel plenty to think about. I am actually a bit excited to see what he builds. Knowing him, he will probably have a fully functioning grid by next Tuesday.

Herman

And I will be right there to help him configure the networking. It is going to be great.

Corn

Before we wrap up, I want to address one more thing in Daniel's prompt. He mentioned the home inventory system. That is such a specific, nerdy thing to host. It really highlights how much we rely on these systems once we start using them. If you can't access your inventory, you don't even know what you have in your own pantry.

Herman

It is the extended brain theory. We are offloading our memory to these machines. When the machine dies, a part of our brain effectively goes offline. That is why the grid isn't just a hardware preference; it is a cognitive safety net.

Corn

A cognitive safety net. We are on fire with the metaphors today, Herman.

Herman

I am feeling inspired! Hardware failures have a way of doing that to you. They remind you of what is important.

Corn

Truly. Well, I think that is a great place to leave it. Daniel, if you are listening, good luck with the power supply repair tomorrow, but maybe start looking at some of those tiny P Cs on eBay tonight.

Herman

And check out the Turing Pi website just for the eye candy. It is a beautiful piece of kit.

Corn

Absolutely. This has been a really fun one to dive into. It is one of those topics that seems technical on the surface but is actually about how we live our lives and how much we trust our tools.

Herman

Exactly. It is about building a foundation that can actually support the weight of our digital lives.

Corn

Well said, Herman Poppleberry. And hey, to everyone listening, if you are enjoying our deep dives into these weird prompts, we would really appreciate it if you could leave us a review on your podcast app or on Spotify. It genuinely helps other curious people find the show, and we love hearing what you think.

Herman

It really does make a difference. We see every review, and it keeps us motivated to keep exploring these rabbit holes.

Corn

You can find all our past episodes and a way to get in touch with us at our website, myweirdprompts.com. We are also on Spotify, of course.

Herman

Thanks to Daniel for the prompt—and for being a great housemate, even when he is accidentally plunging us into the dark ages.

Corn

We will get those lights back on soon, Daniel. Don't worry.

Herman

Until next time, everyone. Keep your servers cool and your backups current.

Corn

This has been My Weird Prompts. Thanks for listening.

Herman

Bye for now!