Beyond the Network: Anatomy of a Shutdown

Companies worldwide have been shutting down for a handful of days at the end of each year. Proponents say it's a good way to reduce energy consumption, lower operational costs and give employees downtime. For some businesses, though, it's not as simple as locking their doors and turning off the lights. Cisco completed its 10th annual shutdown this year, closing about 400 buildings in 70 countries for 10 days and saving 2,700 metric tons of carbon emissions. Several of those buildings include labs of sophisticated equipment worth hundreds of thousands of dollars and – if they malfunctioned – would cost much more in lost productivity. Always-on the rest of the year, they're vulnerable to fail when finally powered off and later restarted.

How does Cisco manage the countless logistical details of a company shutdown executed on a global scale? Experience, a 1,700-line spreadsheet, and the promise of ice cream. Doug Alger explains, as we go Beyond the Network.

The next time you see a computer room in a movie or television program, listen closely. The space – whether a futuristic chamber with a supercomputer inside or a cluttered back room with a jumble of keyboards, monitors and soda cans – is probably whisper quiet. In real life, though, computer room managers dread silence.

That's because a productive, operating computing space is noisy. Machinery, air conditioning systems and power supply fans all make noise. If a computer room is quiet, odds are that power has failed or infrastructure has malfunctioned. For equipment that has run continuously for months or perhaps years – even a planned shutdown carries risk. Like an idling car with an aging battery, the owner knows if they turn the device off, it might not come back on.

Why, then, would a company ask its people who run computer rooms contributing to its bottom line to turn them off?

Cisco has conducted a year-end shutdown for the past 10 years, typically for 10 to 12 days each. Employees in North America are required to take time off, and those around the world are encouraged to. With much of the workforce inactive, there's also an opportunity to power down equipment – for those who are willing.

TONY YOUSSEF: "Part of the infrastructure – we have a lot in the infrastructure – not knowing what would happen, if and when – not if, but when we come back – and turn on this piece of test equipment or a chamber, whether it would power up or not. Shutting down certain pieces of equipment, or a certain thing in the infrastructure for a period of 10 or 11 or 12 days was not something that we knew how to deal with and we were ready as a backup plan should something occur, what is it that we're going to do as a backup. Prepare for the surprises."

Tony Youssef runs the Products Compliance and Certifications lab at Cisco headquarters in San Jose, California. It's a huge facility, occupying most of the ground floor of the building it resides in.

That's an Electro-Dynamic Shaker table, performing a packaging test, one of multiple test beds running here now. Thousands of Cisco products are tested in this facility each year, punished really… subjected to everything from violent shaking and temperature extremes to magnetic interference and atmospheric pressure

All of the testing activity – whether mimicking an 8.0 earthquake, generating 300 Gs of force or producing a chilly -40 degrees Celsius – affects Cisco's bottom line. A product must be certified before it will be manufactured and sold, so delays mean a longer time to market and therefore lost revenue.

TONY: "The very first thing that comes to mind is keep business running and keep our commitment to our stakeholders in check. There are two very important functions that we do among so many other things. Running the labs for support and development. And at the same time we use the same existing infrastructure, labs and accreditation to self-test and self-certify. And the certification is one of the key components that is mandatory to deploy the products legally in the marketspace. So how do we keep our commitments while we keep the commitment to the company, too, and be in line with everybody else and have a shutdown, was the very first thing that comes to mind. Business. It's all about business."

Cisco implemented its first shutdown in 2008. The goal then, as now, was to save energy, reduce carbon emissions and give employees an opportunity to recharge.

TONY: "The benefit is obviously, we – like everybody else in the company – while everybody else is off, it's good to take time off and spend it with the family. The first time around was probably a bit surprising. Now we look forward to it, where everybody is off and you don't need to worry about checking e-mails or something is missing or somebody's not showing up, or not meeting somebody's schedule. So we know that everybody is off. We're all on the same page. And therefore, I look at it as the only probably true vacation for somebody at my level paying attention to what we do for the company."

Tony's team has even found ways to put the lab's downtime to productive use.

TONY: "This year we used the opportunity to do service on one of a major piece of test equipment that's very crucial part of doing mechanical testing. So the shutdown came in at a perfect time where we did not suffer any downtime. By the time we came back the equipment was back up and running. It's like brand new – serviced and calibrated and whatever needed to be done was done during the shutdown."

We're going to go into an environmental chamber within the compliance and certification lab, tagging along as engineers on Tony's team power it off. First things first, however. Step one in any successful lab shutdown and restart is planning. This typically begins weeks or even months in advance.

DIRK STOECKMANN: "One of the lessons learned is you need to know what you want to achieve. So, from a pure perspective set the targets right. Everybody who is participating in the lab will participate in the overall roles and lab shutdown is one of them. Let them know up front. Don't come in let's say last week of December – 'Wait a second, you need to shut it down next week.' That will not work. So, give them a heads up as early as possible. So, November time frame is a good start. They have more than six weeks to think about what they need to shut down and how to do that. And then from a pure – how to proceed? What are the sequences of shutting things down versus I need to bring it up in January again? What is the first thing I need to turn on? Or what is the last thing to turn off to have a complete data safe shutdown?"

Dirk Stoeckmann is a technical solutions architect on Cisco's worldwide Data Center sales team. He has managed a field lab in Dusseldorf, Germany since joining the company 17 years ago. Although Cisco doesn't mandate sites outside of the United States and Canada participate in the year-end shutdown – and even in those countries lab participation is voluntary – many lab operators worldwide turn off much of their equipment. The space Dirk manages, containing 21 racks of hardware, has shut down systems since 2011 and achieved some of the highest proportional energy savings among Cisco's European buildings in 4 separate years.

DIRK: "The lab is primarily used for customer demos, for pretty much every technology we can show and setup in the environment. We have for all the architectures specifically demos from the local people in the lab. So there are use cases for security, we have a very large footprint in regards to Unified Communications. So pretty much

every IP endpoint, either video or voice endpoint, is in a showcase somewhere in the lab environment. For my personal environment, or the personal lab I'm maintaining, is a complete Data Center solution. So, starting with UCS, Nexus 9k, ACI. All the software-related stuff. Turbonomics, Infoblox, all this integrational pieces customers want to see and have a look and feel about before they make a decision to buy that type of solution."

Dirk says he and the other dozen administrators involved with the lab see the annual shutdown as a regular part of what they do. Aside from its energy reduction benefits, the shutdown actually provides them valuable opportunities to learn.

DIRK: "With every new technology we bring into the lab, like the latest integration in software developments like the Turbonomics stuff and all of the container stuff, you learn immediately again, ok this is in a different way to do it rather than the previous setup. So, VMs are different than Docker containers and so on and so forth. That being said, one of the benefits we get out of it, you have hands on experience and that is what customers really like to see, that you're talking about things you know rather than 'yeah, that's supposed to be.' Customers really appreciate if you have experience in this kind of shutdown and bring-up-again process."

That experience includes hardware malfunctions. Two hard drives in the field lab's gear failed to come back on during the most recent shutdown. Even that has it benefits, Dirk says.

DIRK: "Yes, you get a lesson learned again. You really want to understand 'Why doesn't it work the way I expect it to work?'. I mean, that is what every great architecture is incorporating. If there is a failure you need to react on your processes, and that is what we can learn from a shutdown as well, right? So if you shut down your VCenter first and want to migrate or move machines in the shut state, that doesn't work. So you learn it probably the hard way just to do it in the right sequence."

IT systems have grown more complex over the years. Virtualization, automation, programmability – these things enable computing hardware to be more efficient and complete tasks more quickly. That same sophistication, though, makes it more complicated to safely shut down and later reboot them.

DIRK: "If you talk about our legacy stuff, right, the routers and switches, all these IOS based features, they are quite easy to shut down and un-shut. If you turn off the power on a switch that's easy. It will probably come back up. The worst case you may have is you lose your configuration because you didn't save it during the last bring-down and bring-up again. Well, that's not too bad. If you talk about the more complicated software solutions like Unified Communications, like the Data Center footprint, if you work around applications, automation, virtualization, you have a lot of more moving parts in your activity. And that is really more complicated. That is why you need to spend the time on, think about how to bring it down, just to have a controlled process not to lose data, and to bring it up again. So, that is really more interesting. The legacy stuff, like, if you power up a Nexus point, it will probably show up again. If you bring down your Word Press application with will all of the storage and virtualization tiers, there might be a failure because your process is not correct and so there are more complicated parts to bring down rather than others.

Beyond planning the technical elements of safely powering down systems, Cisco lab managers have found it essential to spread the word of the shutdown to their clients – early and often.

UDAY KUMAR SONTH: "People on their own probably will not be ready to come forward and power down their equipment. But a little of persuasion, a little of top-down messaging and bottom-up approach probably will help us create an ecosystem where we go in the middle part and collaborate with the engineering teams and help them power down."

Uday Kumar Sonth manages an engineering lab at Cisco's campus in Bangalore, India. They have been shutting down portions of its hardware for eight years. He oversees about 220,000 sq. ft. of lab space devoted to software development and testing. Feature testing, solution testing and even customer demos run for days at a time here.

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The hardware supports about 8,000 users and accounts for 80 percent of the energy consumed by the Bangalore campus' 10 buildings.

UDAY: "The biggest challenge is the mindset of the folks because they need to be persuaded to become partners with us to power down the equipment. They need to be reassured a lot actually, that their equipment comes back. So, that is the biggest challenge that we face."

Some lab managers begin alerting clients as many as 3 months in advance. They employ a mix of high- and low-tech solutions, going above and beyond e-mail. Uday uses Cisco's Digital Signage service – networked video screens that display messages and videos in Cisco buildings, cafeterias and fitness centers.

UDAY: "So we had infographics created and periodically it was played on digital signages which were 50-plus distributed across the campus. That also helped people ask a lot of questions. So that is good. More questions is a good thing because we knew that people are observing the things, people are reading the things and people are thinking about the shutdown.

His team also prints posters, attaching them to lab doors and in common areas, warning that equipment will be turned off. A power icon appears prominently in red on the page.

UDAY: "So what we have been doing is that we have been sending several communications periodically. We have also been putting enough signage and posters everywhere, which only means that the lab team is much better prepared to handle this shutdown and that folks do not have to be really scared of. But at the same time we try to educate them by giving historic background as these kind of things have probably not happened much, maybe once in a while. What they need to expect is that their equipment comes back rather than thinking that their equipment doesn't come back."

One simple but effective change they made for the last shutdown? Doubling the size of the posters.

UDAY: "For the main entrances of the labs, we put up the A2 kind of posters. A2 sized posters picked up really a lot of attention I should say, because they were at the main entrances of the labs. They were in the hallways. They were in the printer bays. They were everywhere for people to see. I could see that many times the users while passing by, they were very curious to look at exactly is happening, what is written in the poster. And fortunately we had very big infographics on the posters clearly messaging out to the folks that this is something related to power down or shutdown. And when they got closer and started looking into the poster because it was colorful, visible, big fonts, everything, the messaging was also clearer."

After eight years participating in the annual shutdown, it still comes down to a lot of one on one conversations.

UDAY: "The biggest surprise is that users, despite all communication, all education, people still keep asking the same questions and we need to clarify them again and again. So that's one of the surprises. We keep just wondering why people do not understand why we are doing all of this. Because this is a Cisco-wide activity, not just focused at one particular geography or a lab. So that's a surprise. But you smile and you try to help out on all of this.

Uday's team recently deployed Cisco energy management software. They plan to use it in the next shutdown, to help guide what racks to power off.

While lab managers like Tony, Dirk and Uday oversee the shutdown of their specific computing environments, Cisco's real estate and facilities organization, known as Workplace Resources, manages the overall program. It's a global effort – Cisco's last shutdown involved some 400 buildings in 70 countries.

Catherine Paquette is an energy and sustainability manager for Workplace Resources, and Andy Smith leads their global energy management and sustainability team. They spoke recently about how they track which labs around the world will power down and – perhaps more importantly – which ones won't.

CATHERINE PAQUETTE: "We have created a Smartsheet, which – I'm not sure if you're familiar with that, but – it's basically an Excel document that we can share amongst multiple different people and they can all be editing it live. So, we've shared that Smartsheet with many of the different lab managers across Engineering and Services at Cisco and have asked them to mark whether or not they think they're going to be participating in this year's shutdown. We'll have a line item for each lab and they'll fill out their details in the correct line."

ANDY SMITH: "It's worth noting that we've got over 2,000 labs and a lot of employees that work in those labs. So knowing which labs have testing or projects that do continue during the shutdown, that's really important because that allows us to make modifications to our building systems to make sure if a lab has to stay up and running during a shutdown for any reason – sometimes there's customer reasons or other initiatives that have to continue during the shutdown. We need to know about it so we're not shutting down the lab space, the lights, the cooling, during that time. I think this past year we had around 1,700 or so responses – I mean, we've got a lot of labs, right? We have to know which labs are going to be up and running and which ones are not, so we can set our buildings according to that information. It certainly is a big effort when it comes to communication and engagement with especially our lab groups throughout the world."

They're also responsible for tracking how much energy Cisco saves and carbon emissions are avoided. The most recent closure, which lasted 10 days, accounted for 5.2M kWh and 2,700 metric tons of carbon dioxide. Include those in the program's total savings since it began.

ANDY: "We started this a number of years ago. Since FY10, so this is over the last 8 years, we typically save between half a million and a million dollars when it comes to cost savings. So over the last eight years or so we've saved a little over $6 million when it comes to energy costs, by turning equipment off, which is a huge amount of savings. And that translates when it comes to electricity that translates to 60M kWh and has allowed us to avoid 28,000 metric tons of greenhouse gas emissions. That's tremendous impacts just on the emissions alone. That's like taking 6,0000 vehicles off the road or planting over 700,000 trees. So, definitely we're talking big numbers here.

The annual shutdown is a key part of Cisco's overall environmental efforts. In 2017, the company cut its Scope 1 and 2 greenhouse gas emissions – direct or indirect emissions from sources they own or control – by 41 percent compared to its 2007 emissions. The company is now aiming for a 60 percent reduction.

ANDY: "The shutdown collectively is one of the single largest projects that we do every year to save energy and help us towards our sustainability goal to reduce our greenhouse gas emissions by 60 percent as of 2022. So if we don't do this shutdown and we don't do well on it, it makes our job a lot harder to get to that goal.

Pacific Gas and Electric, one of the largest combined natural gas and electric energy companies in the United States, provides power to Cisco's San Jose campus, which includes more than 40 buildings. Frank Arroyo is a customer relationship manager for PG&E. He considers the savings from the company's shutdown a significant achievement.

FRANK ARROYO: "Cisco has implemented a substantial amount of energy efficient projects and has been a leader partnering with PG&E on successful projects. We've completed waterside economizer projects, data lab HVAC controls, along with this holiday energy conservation effort. The extent of the annual shutdown and the employee effort is, from my perspective, though, unique and commendable."

He sees the Cisco's annual shutdown and the company's overall environmental goals as providing broad benefits.

FRANK: "To me, Cisco's sustainability objectives incorporating an energy efficiency program has been imperative. Cisco's energy manager, the operating team, along with support from employee initiatives such as the holiday conservation effort, has benefited not only Cisco with energy and cost savings but in addition all customers benefit from the related benefits including greenhouse gas reduction, air quality enhancements, and reducing our cost to serve."

Computer labs account for the greatest energy use among Cisco buildings. Labs aren't required to be part of the annual shutdown, though, so the magnitude of the program's impact hinges largely on the willingness of lab employees to assume extra work and risk. Catherine with Workplace Resources explains how they sweeten the deal for participants.

CATHERINE: "We incentivize employees to take part in the shutdown in a number of ways. We also try and work with them to make sure that they know that sustainability is important to Cisco and it's everybody's job to participate in our sustainability efforts. But on top of that we have prizes for buildings who are able to reduce their energy consumption by 40 percent or more over the shutdown period. The prizes for them are a lobby plaque that states that they saved X amount of energy over the shutdown for Cisco. And then they also get a building ice cream social where everyone in the building is invited to attend. And typically we'll have a representative from WPR or a representative from the labs speaking, or even both, to talk about how great the result was in that building. We've also had a whiteboard artwork competition, which is an event where employees draw a creative message reminding their employees in their office to shut down on public whiteboard. And so they snap a picture of their artwork and then they submit it to us and we reward the top designs with a small Amazon gift card. Something new that we did this year as well was look for lab energy champions who we can reward within the different Engineering and Services team who really went above and beyond to turn off equipment in their own labs. And so we'll be rewarding them with a recognition from their manager, a mug so that they can use a mug and not a paper cup. Yeah, it's a good program."

Never underestimate the power of ice cream, or a thank you.

TONY: "Although it may sound silly or small, a lot of time a small thing goes a long way. Telling somebody thank you and and thank you with an ice cream goes a long way. Now people are looking forward for the next year, knowing that most likely we're going to be up there. If we're not the winner, we're going to be up there this year, too."

That's Tony again from the Products Compliance and Certifications lab. It's late on a Friday afternoon, the day before the shutdown, here on Cisco's San Jose campus. Staff members are powering off individual systems as their remaining test activities conclude.

Engineer John Krahner has been with Cisco for 21 years. His work focuses on mechanical product safety and quality. He has entered one of the lab's environmental chambers to power off it and the hardware he and his co-workers just finished testing. The team has been involved in Cisco's annual shutdown since it began in 2008. That first year, they were particularly concerned whether these old chambers would come back on. It's time to turn them off, one more time.

UNIDENTIFIED VOICE: "Can I shut this down now?"

JOHN KRAHNER: "Is this ready?"

UNIDENTIFIED VOICE: "It's ready."

JOHN: "As you can tell, we're running temperature profiles on our equipment. We run a functional test for 8 days. It's at its final phase and now we're going to be shutting down this system over here… So, we're going to shut the chamber down first. All the chambers have to be shut down… This is the Cisco 9400 series, and now we're going

to shut down the system... And then there's support equipment that's got to be shut down over here… That completes the shutdown for this system and then we will not be starting until January 2nd other equipment going in here."

It'll be all quiet for the next 10 days, at which point John and his co-workers – here and in Cisco labs around the world – will carefully and deliberately restart their equipment and hopefully return to business as usual.

You've gone Beyond the Network, with Cisco IT. This episode was written and produced by Douglas Alger. Special thanks to Angie Rodriguez and Arthur Woo for recording assistance. Follow and like our podcast on SoundCloud or iTunes. Visit cisco.com/go/ciscoit for episode transcripts and related content.

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