Q+A WITH
KELSEY HIGHTOWER

GOOGLE'S OPEN SOURCE ADVOCATE ON EVERYTHING CLOUD

BY FREDRIC PAUL

Google Cloud Principal Engineer Kelsey Hightower, recently described by *Protocol* as "[one of the most prominent and respected faces in cloud computing and open-source software](#)," talks about how 2020 changed the cloud, the rise of managed services, open source as a service, Kubernetes as a design principle, and the importance of a good story—plus how to whip up vegetarian chili.

How did 2020 affect the cloud?

Kelsey Hightower (KH): It depends on where you're coming from. When the pandemic hit, if you were unable to go into the office, but still wanted to be productive and collaborate, this cloud thing sure sounded like a great idea—the idea that you could log in and meet over Zoom, Microsoft Teams, or Google Meet and collaborate in real-time versus emailing back and forth. People got

a chance to leverage those services as part of their core collaboration workflow, and for many organizations, those services were critical to business continuity. It's amazing how many companies rediscovered video conferencing in 2020.

If you invested in a lot of infrastructure that you could no longer use because of the pandemic, you're just sitting there holding the bag. This whole "scaling-to-zero" idea suddenly sounds really interesting because now you have a true forcing

function. It's no longer a theory. It's now a reality.

Were there significant cloud technology advancements during 2020?

KH: In 2020, you saw many providers say, "Hey, your favorite open-source project is now available as a managed service." This ranged from the major cloud providers to the teams behind those projects. Managed services were already on their roadmaps, but 2020 was a great forcing function to get those things shipped and delivered.

On the health front, we saw the rapid development of things like contact tracing. In a span of a few months, companies were able to collaborate and ship something that could be rolled out to the masses, thanks to the existing cloud and mobile infrastructure. So, not necessarily new technologies, but people were able to leverage existing ones that have reached maturity over the years.

What about the cloud is ripe for rediscovery?

KH: What I hear from people can be summed up as, "Make the new thing work the old way." If you look at the complexity of cloud, most of it has come from customers asking for things they're familiar with, like firewall rules, for example. The VPC (virtual private cloud) firewall rule concept attempts to replicate what you do in a traditional data center—restrict communication between IP addresses.

In the cloud, what you really want is a policy. You want a policy that says, "This application can talk to this application." You don't care what IP address the application gets because it could run anywhere, in any region, across the globe. Static firewall rules can never address that particular set of constraints. Once you start targeting IP addresses, that limits you to a single zone, or region, versus something that can work globally. If you want to be able to scale, and get the availability that comes with it, then you want higher level policy at the application layer.

In a data center, you say, "This IP can do these things." Well, any app can assume that IP and start abusing a security policy. IP addresses are a weak form of identity, and not suitable for building robust security policies and enforcing them. By saying, "Make the new thing in the cloud work like the thing in my data center," you lose out on all of those capabilities that can improve your security posture.

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Most people won't admit this, but you can obtain most compliance certifications while still storing usernames and passwords in plain text files. That's the status quo for most organizations. But in the cloud, we enable you to do away with things like static credentials. We provide tools including identity management, where a short-lived token is explicitly used to grant access for a particular service to another service. That's another example of a cloud advancement that goes under-appreciated because people prefer something that's familiar.

You mentioned the rise of managed services during 2020, why is that important?

KH: People use tools to complete tasks and solve problems. Most tools play a small role in a much larger system. Let's take Redis for example. You start by saying, "I need to store data. Redis supports the data models and access patterns that I wanna use, and it's fast." But you can't just run Redis in thin air. You're gonna need some machines, networking, and security layered up and down the stack. Oh, and you'll need to configure it all so it plays well together. That's just the day one concerns. Once you've deployed Redis you're now on the hook for ongoing security patches and upgrades. This is not what most people signed up for.

This is where cloud providers shine. Cloud providers not only provide ping, pipe, and power, they also provide a set of managed services on top and the expertise required to run them well. Going back to the Redis example, now you can leverage a service based on open standards, and focus on using Redis, not managing it.

From the enterprise point of view, they're saying, "I believe you can do a better job than I can because this is your primary focus." Instead of buying products and running them themselves, organizations are looking for something more, they want solutions. They're looking to buy expertise.

Is that a function of 2020 or was that progression inevitable?

KH: It was inevitable. Whether it's Redis, or firewalls, most people want to consume these things as services. Going forward, more people will re-platform on top of managed services, and delegate a subset of the responsibilities to a provider, like we do with public utilities. Most people don't know how to treat water, or manage the plumbing infrastructure necessary to distribute it, so we put our trust in public utility companies, and govern how they operate, so the rest of us can drink clean water right from the faucet.

What other cloud trends do you see for 2021 and beyond?

KH: Traditionally, privacy and security was an afterthought. You built your product for scalability and ease of use, then you layered on privacy and security when you needed it. But now, privacy and security is an end-to-end requirement and viewed as part of the overall user experience. People want to know what happens when they hand their data over to your platform. It's their data, and they want control

over it, and in some cases, they want to limit what service providers can do with it, or even view it at all.

So, some of the biggest trends we're seeing are around how customers share and manage access to data. Most companies generate and collect a lot of data but struggle when it comes to sharing that data with others, even within the same organization.

The question then becomes, how do you establish trust when you don't necessarily want to trust an entire organization, and ensure data is used only for the purpose intended? Well, a new approach requires we limit access to data to specific versions of software, software that has been audited and signed, and move away from trusting organizations, but rather the software operating on the data. This would give us the ability to revoke access to shared data in ways that were not possible a few years ago, and given the trajectory of cloud technologies, especially around trusted computing, the ability to do this is now possible today.

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We'd be remiss if we didn't talk with you about Kubernetes. How is its role evolving?

KH: We're learning that you can apply Kubernetes' design principles, which we call the Kubernetes Resource Model (KRM), to other things. Imagine a world where you can define a CI/CD pipeline through a set of declarative configurations. Imagine if Redis had a KRM interface. You could do something like, "Hey, Redis control plane. I

GETTING TO KNOW KELSEY HIGHTOWER

How has 2020 changed how you live and work?

KH: There's something special that happens when people get together to share ideas and experiences. That's how memories are formed: I don't remember the last successful code that compiled on my laptop, but I do remember the last time I had dinner at my favourite Ethiopian restaurant.

2020 was a really tough year for many people, so I committed more time for office hours. I jumped on Twitter and said, "Send me a direct message, we can hop on a Google Meet and chat about whatever you want." I attracted many up-and-coming developers as well as those struggling to work from home. I found that by doing it virtually, I was able to connect with many more people than normal. I think that part is what I enjoyed the most.

And I'll be honest—as someone who travels probably too much, being home with my family was a welcome change of pace. Now I have time for the simple things, like grabbing a burrito with my daughter during our lunch breaks, and catching up on new music.

Is there anything specific that you did with your family that you'd like to share?

KH: I'm really big into financial freedom, minimalism, and living without debt, especially consumer debt. Just like tech can be very empowering for people building things, it's equally empowering when people have control over their financial situation. During the pandemic I was fortunate to have time to invest in my 13-year-old daughter's financial education. I finally got her a debit card and taught her how to use it. I also

taught her about fraud prevention, budgeting, and how to think about saving money. She's enjoying watching her allowance go into her bank account and the power that comes with having full access to it.

Later on, we're going to pick a few stocks based on the products and services she consumes as a way to get her into investing, and understanding the companies behind the products she uses. As a young lady, she has reached a level of independence and maturity that I didn't reach until much later in life. That was very special to me.

Since many folks have been eating at home a lot more in 2020—do you have any favorite dishes or recipes you'd like to share?

KH: I actually learned how to dice an onion properly and now the pieces look like squares and not little jigsaw puzzle pieces. Also, I'm vegetarian and I found a way to make chili that people seem to like, using Impossible Burger [plant-based meat].

You need a can of black beans, a can of kidney beans, a small can of yellow corn, and two cans of diced tomatoes with a little green chili in them. Brown half a diced onion with a tablespoon of olive oil, and toss in a whole pack of Impossible Meat, which browns just like ground beef. Dump in a pack of the chili seasoning that you get at the grocery store. Once it cooks for about 10 minutes, start adding the drained beans, diced tomatoes, and corn. From there, you just taste it and add a little hot sauce or whatever else you need to give it that spice you want. In about 15 to 20 minutes you should have some chili that would even fool your carnivore friends.

want a five-node cluster across these zones, and I want this much memory allocated to each cluster member," and then Redis would go and provision itself. That's what we mean by applying the KRM model to other systems.

If you explore the internals of Kubernetes you'd discover that Kubernetes adheres to its own design principles. It's not just one big binary that you install and run. It's actually a set of components that leverage the KRM. Kubernetes is built on the fundamentals of config management, which is built on the fundamentals of promise theory. There are resource definitions, and chunks of code that run in a loop, that work together to turn resource definitions, also known as promises, into running applications that match the desired state.

It turns out you can manage more than containerized workloads using such a model. Now storage appliances and network fabrics are fair game, and this realization is pushing Kubernetes to evolve into a universal control plane.

Kubernetes is a prominent open source project. Do you have any thoughts on the state of open source software?

KH: The bar has risen dramatically since I got involved in the late 2000s. I've grown to see open source as a way to serialize our ideas, make them tangible, and share them with people. Those people form communities and create feedback loops that help us improve upon the initial idea. That's the power of open source, it's the ultimate collaboration model for serializing innovation.

Today we live in the world of managed services, which brings along a new set of expectations, so the question we have to ask is, how does open source accommodate the people who are more interested in using software, not downloading, installing, and managing it? Let's Encrypt is a real-world answer to that question. Let's Encrypt is a nonprofit, backed by a healthy open source foundation, focused

on securing the internet by democratizing access to critical PKI infrastructure—think HTTPS and that little lock you see in your web browser when you're dealing with a secure connection.

For example, if you were to visit takemycreditcard.com, you want to do that over a secure connection, and that requires the website owner acquire and configure a SSL/TLS certificate. Just a few years ago it was common to pay hundreds of dollars for a reputable company to give you an SSL/TLS certificate. You would essentially send them a certificate request and after a few days you'd get an email that read, "Your certificate has been approved, and here are instructions on how to retrieve it." Then it's on you to configure your web servers to use the certificate, and as an added bonus, you got the privilege of doing that every year. Of course, most of us would forget, and our certificates would expire, and force everyone to scramble to get it renewed before the CEO found out.

"The cloud made it easier to provision infrastructure, but it did not eliminate the toil of managing it."

Let's Encrypt comes around and says, "We're gonna automate this end-to-end. We're gonna give out SSL/TLS certificates for free. As a nonprofit, backed by an open-source project, we'll enable others to run our software, and become their own providers, but on day one we're gonna offer a fully managed service so you don't have to." Now we have letsencrypt.org, where most software—even Kubernetes—has the ability to generate industry standard SSL/TLS certificates automatically and keep them up-to-date in the background at no cost to you.

We've gone from free software to free service. That's going to push the bar for what it means to have a successful open-source project, especially for big, popular open-source projects backed by foundations and large organizations.

What are you working on in 2021?

KH: Democratizing infrastructure. It's the original promise of the cloud, but now it's time to move up the stack, and help liberate people from the massive liabilities that come with managing infrastructure, without locking them in. Managed, but open, is the key to democratizing this stuff. The cloud made it easier to provision infrastructure, but it did not eliminate the toil of managing it. In 2021, I'll continue working to figure out how to give people a reliable platform to run their applications, and manage their data, without the overhead of low-level system administration— moving in that serverless direction for as many layers of the stack as possible. Cloud Run and Cloud Spanner are two big areas of focus for me this year.

You're known for being an inspiring figure in the tech world. How do you motivate people to care about their work?

KH: I learned how to tell the story of why I'm doing what I'm doing. If you pick Kubernetes because you read a blog post, and now you want to install Kubernetes, that's not very compelling or inspiring. That's irresponsible and possibly dangerous.

When you have a story, you're able to walk into a room and say, "Hey, our system has gone down 30 times in the last month, because we didn't have the ability to track resource utilization, or restart applications that fail. After installing Kubernetes, I noticed it's keeping our applications running better than our current tool, and we went from 30 to 2 outages as a result."

That's the kind of inspiration most people want. Clarity around a specific problem and a possible solution that is showing early signs of promise.

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