Intel Corporation

Video Analytics & Location Aware Services at the 5G Edge

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PRESENTATION

Lilian Veras

Welcome, everyone, to the Intel Network Builders webinar program. Thank you for taking the time to join us today for our presentation titled Video Analytics & Location Aware Services at the 5G Edge".

Before we get started, I want to point out some of the features of the BrightTALK tool that may improve your experience. There's a Questions tab below your viewer. I encourage our live audience to please ask questions at any time. Our presenters will hold answering them until the end of the presentation.

Below your viewing screen, you will also find an Attachments tab with additional documentation and reference materials.

Finally, at the end of the presentation, please take the time to provide feedback using the Rating tab. We value your thoughts and we'll use the information to improve our future webinars.

Intel Network Builders webinar series takes place live twice a month, so check the channel to see what's upcoming and access our growing library of recorded content. In addition to the resources you see here from our partners, we also offer a comprehensive NFV and SDN training program through Intel Network Builders University. You can find a link to this program in the Attachments tab, as well as a link to the Intel Network Builders Newsletter.

Today we're pleased to welcome Tyler Manning from Kloudspot and Mehran Hadipour from Robin.io.

Tyler Manning leads global sales engineering and customer success at Kloudspot. He found his love for engineering early on in life, and he started his career as a software engineer, spending some time working at HP as a firmware engineer.

Mehran leads Alliances at Robin and is responsible for Robin's industry partnerships and Alliances strategy. A respected industry veteran who is passionate about driving business success through alliances and win-win partnerships, Mehran brings to the table years of experience in executing and driving change at major infrastructure and enterprise software players, such as EMC and IBM, as well as several Silicon Valley based startups and high technology firms.

Welcome to both of you. I will hand over to Mehran to start off. Thank you.

Mehran Hadipour

Thank you so much for the introduction, and appreciate you all joining to listen to this talk. Please keep it interactive and ask questions as we go forward.

A little bit about Robin and Robin's mission in life. We have been in this whole cloud native space for over 10 years and our focus is to accelerate deployment and automation for running 4G/5G and Stateful applications on Kubernetes. We are actually one of the only Kubernetes distribution providers that is running the entire 5G stack on a cloud native environment in production today, in Rakuten

Mobile, and have a number of key deployments in Fortune 1000 companies, including banking sector and healthcare and higher education to name a few.

A little bit about Robin company in detail. We are headquartered in San Jose, California. We have offices, engineering offices, in India, in a couple of locations, and sales offices globally. We've collected an experienced team of engineers, who've been working on this whole open cloud native space since the inception, before even Kubernetes was a standard. We have a large number of patents, awarded and pending, focused around different aspects of Kubernetes and the storage that have been awarded. We started our journey, as I mentioned, in the enterprise sector with a number of key customers running and now been in production for number of years, including bigger names such as Credit Suisse, BNP Paribas, that's banking sector, SAP and USAA to name a few. We also have a number of telco engagements, including Rakuten Mobile which is using Robin as a platform for deployment of 5G.

On partnerships side, Intel's a key partner for Robin. We've been talking with Intel on the OpenNESS platform for quite some time. Some of the components of Intel OpenNESS is part of the Robin stack and we're also uniquely positioned to take advantage of some of the hardware acceleration technologies that Intel is offering in the market for some of these telco use cases, and I'll cover in a little more detail. We've built partnerships around OEMs that are developing hardware, people like Supermicro, QCT, and HP and Dell, as well as cloud providers. So, Robin is available both on-prem and cloud deployments in a number of cloud providers as well. We have been working with a number of telco operators, as well as network function providers, in some of the telco engagements.

As you can see, we have listed just a few awards, but Robin has won many awards. That suggests the robustness of the technology.

So, I want to quickly cover the Robin offerings in this space. Cloud native storage is a Kubernetes storage stack that supports any Kubernetes distribution, and can run Stateful applications on Kubernetes seamlessly, and this is essential for the Edge applications, because many Edge applications have persistent data, and you need to be able to support large scale data management capabilities at the Edge, as well as at the core, and Robin CNS is the platform that does that. Robin Cloud-Native Platform, which is our Kubernetes distribution, is designed to run telco workloads at scale, and can deploy both Edge and core applications on cloud native environment, both in terms of VNFs and CNFs, and I can cover that in a little more detail in the subsequent slides.

Ad another key platform, which is going to be the focus of most of the presentation today is our, MDCAP Platform. In many of these use cases we are going to talk about today, we are deploying a large number of nodes at geographically-dispersed locations, from ground up, with very limited support, and having a Multi-Cluster Automation Platform that can deploy the applications and lifecycle operate them post-deployment at scale, in a variety of locations remotely from the central data center, is an important enabler to support this type of deployments, and we'll talk about some of the benefits of such an automation platform as time goes on.

So, what exactly are the challenges for this whole deployment approach, and these are some of the basic challenges that we see in the Edge application delivery and deployment. One is that there is a lot of elements that have to be managed, including bare metal servers, which are basically often deployed in locations that have very limited IT support and also remote, and you have a large number of small nodes that have to be operated from ground up. A Kubernetes distribution also has to be managed remotely. You have cluster management, lifecycle operations of the cluster, and then you have to deploy these applications on-demand, creating custom Helm Charts for the application, deploying network functions, and tying those network functions together to create network service. All those things are operationally complex, and it is important to achieve hyperautomation, mainly because of the scale of this engagement. For example, if you think about 5G RAN as an example, or 5G MEC as an example, you'll be dealing with a variety of different components from basic metal server with nothing on it, all the way to the point that is participating in a complex network function delivery, and network service, and managing not only the instantiation, but also its lifecycle operations are challenges for the customers to have to deal with. Many of these tasks have to be automated to be able to actually scale this, especially because there's a large number of nodes that have to be deployed.

On the Edge, you have some types of computes matters, whether it's an IoT device or a server that has applications for the Edge running on it. Network orchestration has to be managed. You usually have persistent volumes and data that have to be protected and managed, and you need to have remote operations on the cluster in order to ensure availability of the applications at the Edge.

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So, looking at all these challenges, I think the key factor is that there needs to be some type of automation that can protect, deploy, and upgrade, or do lifecycle operations of the network functional applications seamlessly, at scale, and do it centrally without even touching, and that's really the challenge we saw in there.

So, looking at an example that highly illustrates this issue is that if you consider a deployment of a RAN or Edge platform, from the point in time that a server is rolled in in a base station, with nothing on it, connected to power, and is visible on the network, to point in time, it actually has the appropriate operating system, has Kubernetes installed on it, BIOS is configured, its server is plumb for observability. If there is FPGAs and GPUs that are configured and loaded, the kernel upgrades has to be made and so on, the point in time that an application such as the DU or a MEC, or EMs, is installed on it, and is participating in a network function, has to be orchestrated. So, you have a lot of challenges in different domains, but in terms of Far Edge and core, and they have to be addressed at scale across distributed sites, and this is the problem that Robin is solving.

So, let me quickly highlight a little bit about Robin CNP, which is our Kubernetes distribution that has a lot of capabilities around automation or orchestration within the cluster. CNP is installed, can get installed on a very low footprint. Four vCPU and four gigs of RAM is all it takes to install CNP. And then from that point on, the orchestration and automation takes over.

So, if you think about CNP's components, we start with upstream Kubernetes unchanged that Kubernetes can run in any bare metal server or on any cloud. We add several components to using the standard Kubernetes interfaces to Kubernetes to enhance its capabilities for this type of applications. The first thing is our app-aware storage, which I mentioned. This is is designed from the ground up as a software-defined storage product that can support running persistent workloads on Kubernetes. It provides data services, including data protection, backup, and snapshot, and cloning. It allows you to set quality of service for applications. It does automation around data rebalancing, thin provisioning, encryption and compression, and it delivers all those data services on application boundaries. Typically, the application profile that runs at the Edge or core with a large number of volumes and pods hosting those applications, protecting the volumes is just the beginning. You need to also protect all the available configuration files, secrets. Anything that is needed to restore the application to a different point in time for any type of failure-- device failure, server failure, corruption condition-- and all of that is handled by our app-aware storage layer. The app-aware storage or cloud native storage is available as an independent product, but it is part of our CNP platform.

The virtual networking is another major component that is required for this type of workload. We built a carrier grade network layer using CNI that interfaces to Kubernetes. This CNI includes a number of OpenNESS components, including Multus, for example, and SRI-OV, DPDK. This allows an Edge application, such as video analytics that we're going to talk about later today, that takes advantage of the low latency networks on the fronthaul and backhaul, with SRI-OV enabled, and support overlay networking, and IPv4 and IPv6 support that are natively configured. We also automate the overlay networking, and OVS and Calico networks are provided to allow both management interaction between pods, as well as the inter-pod communication.

So, this CNI is an add-on to Kubernetes that interfaces to Kubernetes using the standard CNI, and replaces the CNI provided by upstream Kubernetes. They also do enhancement of workflow manager or application workflow. We built our workflow manager that interfaces to Kubernetes on private provided APIs. It has a number of unique capabilities that are required for these type of workloads. First, it has very enhanced affinity and anti-affinity policies that allows you to run a complex application such as RAN, or MEC, or Edge, which requires provisioning rules, such as NUMA-aware, CPU pinning, for example. If you tried to run a DU workload on a pod, and you want to place that workload on a CPU, on NUMA boundaries, to ensure high real-time performance, Robin automates all that and allows you to pin the CPU to a specific application and do it automatically. These constructs are very difficult to achieve in the basic help or deployment of application and gives you much more control over how the applications are deployed. They also have an important feature that as we deploy these applications in telco workloads, we realize that not all the network functions are containerized. So, we build a CRI multiplexer that can run both VMs and containers on Kubernetes natively, and treat them as pods, and manage them as part of a single orchestration layer. This allows you to create a unified management platform that supports VNFs and CNFs and creates a pipeline or telco function or Edge application, that is a combination of VMs and containers, and manage them

in such a unified manner. This obviously saves a lot of time and effort on application organization and on onboarding of telco applications on-demand.

In addition to all these advanced placement policies, and also added enhanced observability, including service mesh, and Grafana, and a number of monitoring tools that gives you the ability to monitor the performance availability, and do all lifecycle operations in an automated fashion, including things like scheduling snapshots or upgrades, or cloning of applications, and/or deployment or instantiation of the applications on-demand could also be automated. A Cloud-Native Platform is really what drives the deployment of Edge workloads and automates individual clusters that deploy those functions.

To give you a highlight a little bit about some of the provisioning complexities, if you think about a real-time application, such as video analytics, or RAN, you will be running these things on different NUMA boundaries. Within overlay networking, each pod could have up to four or five different network connections. You could have fronthaul with Calico, backhaul with OVS. You could have multiple SRI-OV connections to the same pod. You need to provision the network function on a specific number of cores and place them on the appropriate NUMA boundary so you don't go across NUMA to impact performance. All this provisioning automation is something that has to be done on an application level, and without having to do a lot of complex tagging and manual operations. If anything has to be done manually on these large scale deployments, in case of 5G as your core for example, the whole deployment of 5G becomes unaffordable, and you need to be-- automation is key to be able to automate the provisioning and also lifecycle operations. If a pod fails, and the pod gets restarted, all these provisioning rules that were specified for the application would be enforced. It allows you to make sure that you can recover from hardware failures without impacting performance, and do it very quickly.

So, I'm going to spend the rest of the presentation around the MDCAP. It has a number of capabilities that does orchestration and automation for these types of use cases.

So, when you think about, how do I get to a point that I have a number of Edge applications deployed at scale in geographically dispersed areas, let's look at the problem and how do we need to solve it. You generally start with a bare metal server that has to be configured and managed, both in terms of instantiation and availability. That bare metal server will get connected to basically an IPXE interface and you have to upgrade the firmware, partition to storage, configure the RAID, configure the networking, install the operating system software, and once you do that, you have to also think about the upgrade of the same. What if you have to put a patch and you're upgrading 5,000 servers in the field for a security vulnerability, driver upgrades, streamer upgrades, software upgrades, all those things have to be managed post-deployment on the server. Then it has to be monitored on an ongoing basis, and monitoring has to be out-of-band. You have to understand-- for example, you have a network failure, you have to then restart the pod or moving the workload to a new pod on the new server. All those things have to be managed at scale. You have to also be able to allow provisioning restrictions, scheduling RBAC control, quota assignment on the usage, and policy and fault management, things around the hardware upgrade and fault tolerance has to be programmed, and there needs to be a dashboard to audit and report on the state of those machines.

Now, MDCAP has this whole concept of inventory that every element in the infrastructure is stored as built inventory, and its status is maintained, and all the operations that you see here could be applied to the inventory, and you could do this in a large number of nodes in a distributed fashion. MDCAP can manage over many elements concurrently. This allows you deployment at scale.

These are some of the services you can build on top of MDCAP. For example, bare metal servers I mentioned. It talks about the operations of metal all the way to the point that the service is deployed. You can add applications on the top to create RAN as a service, or any application, rich application as a service could be deployed, and all of these things could be orchestrated, managed from a central data center on a single Robin-enabled cluster, across the Far Edge. MDCAP can also manage other non-server devices such as IoT devices and other things that require automation.

So, when you think about 5G service delivery, from the radio to Far Edge, to Edge to core, you will have a large number of complex configurations that have to be managed. They are distributed. They are running different application pipelines. You need to create a

service chain that constitutes a number of elements. To take a deployed node and have it participate in a network function, and then create a network service on top, requires end-to-end orchestration, and that's what MDCAP is designed to do.

The other thing is that once the application is deployed, there are a number of things that have to be done on an ongoing basis. For example, you can have methods of procedures that run on the application, and the stack, doing things on the physical layer, like doing upgrades, doing things on the clustering layer, doing things to the network function and application, and network services pipeline, and you need a cluster automation platform that actually understands, OK, I'm having an availability problem or performance problem on such and such a network function. I want to scale that function up by adding more nodes or improving the scale of the pod that is running it, and do it on an on-demand basis. This type of automation is key to be able to make sure that you maximize availability of service delivery. At the same time, reduce the operations costs associated with service.

So, if you think about the entire lifecycle operations, and you think about all the different elements of it, you're now dealing with very complex workflow-driven lifecycle operations management has to happen. For the bare metal side, and all the things that has to be done, to the bare metal and has to be done to scale, from cluster operations, installing Kubernetes, and managing those Kubernetes clusters, to the actual network function delivery, and all has to be operated and managed seamlessly at scale.

So, now that we have a very manageable, orchestrated, and automated deployed infrastructure to host applications, it's important to talk about how some of these applications could add value for this application delivery model.

Edge is proving to be a major way operators are trying to achieve or monetize their infrastructure, and they're looking at a number of ways of doing that. Our partner in Kloudspot will be talking to you a little bit about some of the unique use cases that could be achieved by this model.

So, let me pass it on to Tyler, who will take you through some of the Kloudspot applications and delivery models, and I will answer questions at the end. Tyler, take it away.

Tyler Manning

Yes, thank you, Mehran, and thank you everybody for joining. So, I am from Kloudspot, as Mehran said, and we are one of the many Edge applications that you can deploy with the Robin system, and what I'm going to take you guys through today is what we are, what we do, and what some deployments that we've done in the past might look like to give you a better idea of what our application does inside the Robin ecosystem.

So, Kloudspot is a location analytics, situational awareness company, and that's a really complicated way of saying we go into environments, whether that be an event, a conference, a mall, an office space, and in all of these different venues, there's going to be a Wi-Fi network there that's most likely providing access to the inhabitants of that space, and that's probably about it. You might have cameras in certain locations around that space, probably doing security, recording the happenings and goings-on of that site, and that video would be accessible at a later point in time in case something happens. And then you have a lot of other cases where there's IoT, environmental sensors, CO_2 sensors, temperature sensors, all sorts of other things. There's Bluetooth sensors in these areas. And these systems all provide their own value to the company. Wi-Fi provides access, camera provides security, so on and so forth, but there's additional value that Kloudspot sees in these systems that we like to leverage and utilize for our customers.

So, we go into a site. We integrate with all of those systems already there. We take all of this data into our platform, and we run through this digitization/measuring, cognition, awareness, prediction, and then action loop that we do. So, we're feeding all of this data in from these different disconnected systems, and we're triangulating that data to do something meaningful and impactful with that data. This can look like a lot of different things, as I'm going to talk about a little bit more down the line in this presentation, but this can look like monitoring a customer walking into a mall, recognizing that they're a repeat customer, and changing the digital signage around them to push the most relevant advertisements at them based on the demographics and profile we've created for that individual. This can look like, in an office, monitoring your cubicle spaces and your conference room spaces, making sure that you've reasonably allocated space

to conference rooms and cubicles in a way that they're being used a good amount but not too crowded. Do you need more meeting rooms? Do you need more cubicles? Do you need more conference rooms with a 20-person capacity? Things like that.

And one of the most important features about this platform is the live real-time actions that you can take, and I alluded to this earlier with the digital signage, but you we can actively send text messages, send emails, change digital signage. We can take a bunch of data and go push a button in another system via APIs, so there's an extreme amount of flexibility here around what you can do live real-time.

Now, this is a similar look at the platform. So, we have a lot of different services that do a lot of different things. The important things here are we integrate with everything under the sun. We're not coming into a business or a venue and looking to replace the hardware. We're looking to consume the data from those systems that you already have in place and feed that into our different services. So, a few that I'll point out here, we have our KloudInsight service, which is really the core and the meat of our location intelligence. This is where we find out where people are, where they're moving, where they've been, how long they're spending there.

We have a service called KloudPortal, which we can put on top of your Wi-Fi network, and basically creates a user-friendly gate for people to get onto the Wi-Fi network, and this is, again, an interactive service. So, if we recognize the person logging onto your network, we can go and we can fetch the ad profile for that individual, and feed them the content that's most relevant to them, or we can just interact with them. We can push them surveys based on what they did on the site. "Oh, hey, you've stayed at our hotel before. I noticed you spent a lot of time in the bar. You're logging into the Wi-Fi now. I'm going to go ahead and push this survey in front of you, asking you how you found the service, and quality and environment at the bar", things like that.

We have our KloudDisplay service, which is our digital signage service. You can control every individual pixel on the screen remotely from anywhere in the world, and you can manage a fleet of all of your screens across the globe, and again, push different content based on what's happening around that screen based on who's around the screen, based on the situation.

We have a KloudVision Service, and this is our video analytic service that you can use to recognize objects, people, situations, entries, exits, all those sorts of things. And it's very important to note that this service is something that you can bring into almost every space, really, and the use cases will be slightly different. If you're in a hospital, maybe you're looking at tracking assets. You want to know where your wheelchairs are, and you want to know how many wheelchairs are being used at peak hours, and then if you notice that too many wheelchairs are being used, you can go order some more wheelchairs. In retail, it's really about monitoring customers, understanding their demographics, creating marketing profiles, and understanding where they're spending their time and, ultimately, money in the store, and then figuring out how to better engage and interact with those customers. Workspace, it is all about employees and their experience on-site, how they're collaborating, how they're using the workspace. And also, smart offices. You can use the system to go in and integrate with the HVAC, and if you notice that there aren't any people in a particular room, you can turn it off and save some money on your HVAC system.

The other thing to note here is you can easily-- and with the Robin platform, you can easily start with one service, and then use that service, integrate it into your ecosystem, into your process flow, and then add on top of that other services. So, you can start with KloudInsight service where you're monitoring Wi-Fi and Bluetooth location analytics, you're seeing where people are on your site, you're generating heat maps and dwell-time maps, how long have people stayed in a particular area. You can start with that, and then jump into KloudDisplay, and then you can link these two services together. So, now with KloudDisplay, you're showing the content that you want to be showing on the screen, and then once you link that with KloudInsight, you can change what's being displayed on the screen automatically, without any manual user input based on who's standing around the screen, or who's near the screen. And then maybe you link that with the KloudVision Service, and now you have a camera that's next to the screen that's also integrated with Wi-Fi data, and Bluetooth data, and you're actually looking at who is around that screen, and you're pairing these two pieces of information. You're pairing that live real-time camera data with the live real-time analytics that you gained from the other systems, and that's influencing what's being displayed on the screen.

Now, I want to go through one scenario. So, if we just look at a workplace, and again, this can be applied to many different industries, many different venues, many different circumstances, but right now, I just want to explain what we can do in one. So, at the entryway,

there's digital signage, there's digital displays that's showing company information, and as you walk in, it's going to be integrated with the camera system. So, if you're not wearing your mask, or something, that screen can flip to say, "Hey, we love your smile, but can you please wear a mask while you're in the office", and this is something that we actually have set up at our head office.

We have a check-in system. So, if people are coming in, back to work is a big thing now, people need to book desks before they come into the office, they need to fill out a health questionnaire. Then once they filled out the health questionnaire, and had been approved to go on-site, they get a QR code, they come into the lobby, they scan that QR code. We say cool, you're good to go, and then you head into your desk. We also have temperature reading systems that are integrated into this. So, we can automatically measure the temperature of individuals as they're coming in, and we can say, hey, you're running a fever right now, probably best if you head home.

Once you get on-premise, we can do safety-wear compliance through the video systems around site. So, ideally, we're making sure people are wearing masks, when they need to be, not just as they're coming into the entryway and the front desk attendant is monitoring that, so we're doing that actively throughout the site. We have social distancing monitoring, contact tracing. So, if somebody does come on-site, and then later finds out that they're sick, we can go back in time and say, OK, where were you, number one, and who were all the people that were around you in that area, and how long were they around you for? If you're doing conventional, or using a conventional approach to contact tracing, it's all interview style. So, you come in, you say, OK, where were you between the times of three and five, and, of course, nobody knows. So, with this system, it's a live real-time tracking, we know where you were, we know where you've been, and we know who you were around, so we can build a much more accurate profile of the situation, and then HR can take that data, and figure out what's the best way to inform people that they have been in contact with somebody that's sick.

We have wayfinding and people finding functionality. So, if you have a large company, and you haven't been to a particular site before, we have kiosks and mobile applications that you can pull up, and you can say, "I need to get to Office XYZ", and it will show you how to get to the office from your present location. Same thing with finding people. We know where people are live real-time, you can type in the name of your boss or something, and it will show you where he is actively and then how to get there. For the administrators, there's a lot of analytics that we offer, and one of those that we're seeing that's very important right now is the occupancy monitoring. Basically, all of our customers have some sort of occupancy limitations right now around their sites. So, they don't want more than 50% of the people on their sites. But what that also means is they probably don't want all 50% of those people in the cafeteria at the same time. So, we can actively monitor different areas of the office, and sort of, again, actively do something about it if we breach that threshold.

And then we're doing asset tracking. So, if you have critical assets, expensive equipment, we can track the live location of that, make sure it doesn't wander off-site or wandering to an area it's not supposed to be, and again, we can do surveys and do wellness checkups, through the Wi-Fi portal as people are going through the normal processes about their workday.

And there's a lot more that you can do here. This is a lot of basic use cases. There's also a whole bunch of stuff you can do with smart office where, for example, if I walk into my boss's office, the system is going to recognize, hey, Tyler has walked into Jeff's office, and they're the only two in there. They're going to talk about Tyler's Salesforce numbers, so I'm going to go ahead and flip the screen in Jeff's office to Tyler's Salesforce dashboard, and they can get their meeting started. it. So, there's a lot you can do there.

This is another summary. So, we're doing movement and behavior monitoring, capacity, density, footfall, dwell time, really understanding where people are, where things are, we do both. So, it's not just where people are, but again, things. Insights for energy and resource optimization. We can integrate with lighting systems, HVAC systems, a bunch of other systems that you have on-site, and we can pair that with the location analytics that we have for folks, and save you money, basically. Engagement, so digital displays, captive portals, push notifications, SMS, there's lots of different avenues for engagement, and the most important thing is intelligent engagement, because we're building profiles of people, we're gathering information, we know their location history, what they're interested in, things like that, so you can build smarter engagement. And while I'm on this point, also, I want to make the very important point that we deal with privacy on a sliding scale, depending on what the customers want, and what their policies are. So, if you have super strict privacy controls and policies, we can change what information we're collecting and what we're not collecting to fit that profile. And then on the other end of the of the spectrum, if that's not a concern, that's not an issue, we can turn all the dials up to

max. But the important thing is that the privacy is in our customers' hands, and we don't tell them what they can and can't collect, basically. Health and safety, masks, temperature scanning, health questionnaires before people are coming into the office, all that good stuff. Perimeter security, asset tracking. And then hybrid work environments, so helping people book desks and get into the office, and all that good stuff.

So, now I want to go through some customer cases with you guys, so you can get a better picture of what you might do with this platform. Obviously, I've presented a lot of different things to you, a lot of different services here, but a lot of our customers use the subset of our services that are most appropriate for them. They're not throwing everything in there. They have a problem, they look to us, we figure out what services we offer that are going to best fit the bill.

So, if you look at NEC NESIC, their big challenge was enabling a safe return to work hybrid strategy, and they were hearing from their employees that health and safety was a major issue for them, and they needed a good way to address that, and they needed a solution that was also integrated with their back office solutions that they were already using today. And so, the solution for them was to implement live location analytics, making sure that the site was safe. There's not too many people in one area. There's not too many people going onto the site. We enabled contact tracing for them, so if there was a situation with a sick employee, they were able to look them up, get the information, and then take appropriate action. And then finally, they've enabled desk booking and health questionnaires. So, before employees even get to the office, NESIC has a hoteling, hot desking setup, so employees will select their desk, book their desk for the day, and then fill out a health questionnaire before they go on-site. Have you been in contact with anybody who has COVID-19 in the past 14 days? Are you showing any of these symptoms? Yes or no sort of thing. And the impact for them was they hit all of their health and safety goals, fast migration, they were able to bring people back in immediately who wanted to come back in, and do it safely at the same time. And then here's a quote from their head of business development that I'll leave up just for a second.

All right. Next one is Freedom Financial. So, this is a customer who-- they have some big buildings, they have lots of employees, and they had just set up some new buildings, and they were hearing from their employees that, hey, I can't ever find a conference room around here, and there's not enough space to sit, and there's just not enough space in these buildings, basically, and this was actually affecting their employee Sat scores, so this was a big deal. Not only was it affecting how employees were feeling, but it was also affecting what the executive team was going to have to decide. OK, do we need to go build a new building and spend $20 million on a new building?

The solution, again, was to implement location analytics, looking at where people were, and where they weren't and what times of the day they were, and after bringing our solution in and running it on-site for several months, we were able to generate a report with recommendations around how to change their office layout to fit what the employees needed, and this included adding some conference rooms, taking away some desks that were never used, and modifying the layout of their office. And the result of this was now people have space. They can get conference rooms when they need conference rooms. They find the desks with the equipment that they need when they need to find a desk, and then the employee Sat scores increased quite dramatically once this plan was implemented. And they had massive facility savings because they didn't have to go build that new building. They simply reallocated and reorganized space that they already had.

One of our other customers, and this is a theme park, so a little bit different than the office spaces we've been talking about thus far, Dubai Parks and Resorts. And their challenge was to track, understand visitor behavior and patterns to drive more revenue to the parks. And what they were experiencing, if you've ever been there, they have three paid access parks, so you need to pay to get into these parks, you go enjoy it, and then you head out, and then if you want to go into one of the other parks, you have to pay to get back in. And in the center of all of these parks is a big, free, open air mall area. There's food, there's nice water features, you can sit and joy, there's live music, and everything like that, but it's free to get in, and they wanted to understand who these people were that were coming in and sitting in this free area, and what they could do to entice them to come into the paid parks. And so, what we did is we implemented, again, our location intelligence system, and our captive portal system, and we tracked people across the site. We looked

at people who are going into the paid parks. We generated customer profiles for who was coming in, who was paying, and then what they were doing when they entered into those paid parks, what were they attracted to once they entered the paid parks.

And then they were able to compare that data to the folks who are entering only that free access area, and they were able to say, hey, these people fit the profile of somebody who would like this ride, and we have their contact information because they've logged into the captive portal. So, now I can add them into a marketing nurture campaign, and I can send them advertisements about this ride, and maybe some food, some events based on their demographics, their profile, what we know about them, they would like. And what they experienced from this is increased ticket sales, multiple venue visits, people are coming back, and better event attendance and guest satisfaction because they were being made aware of the things that they enjoyed to do on-site. And again here, we have a quote from the customer. I'm going to leave that up on the screen for a few seconds

Alrighty. So, this customer, this is actually a city, so this is a smart city project, and their challenge was they're doing a public Wi-Fi project, so that's investment on their behalf, and they really wanted to connect, empower, and engage citizens, monetize their investments somehow, and stimulate the local economy. They want to push tourists into local businesses and whatnot. The solution there was Wi-Fi and digital signage. So, again, understanding who is there, what their details are, digital signage, a customized captive portal that feeds local news and local advertisements for local businesses, and then pushes those customers towards that local business, helping them stimulate local economy. And then the impact was reduced traffic congestion, equalized access to technology, and stimulated the economic development there. And again, I have a quote from our customer that I'll leave up for a few seconds

All right, and this is the last customer I'm going to I'm going to share with you guys. I'll go over it quickly, and then we can get to some questions. So, this is a store, Petco, and we did two things for them. We did location analytics and we did a captive portal, and this is what their captive portal looks like. So, we make it very easy for people to come in, sign on. We collect some details from them that Petco can then go back and use in marketing campaigns or to interact and engage with customers. They go through the onboarding process, they encourage them to-- they give themselves a little plug there, "Hey, download the Petco app", and you can click these buttons and go to the Petco app in the Apple Store or the Google Store. And then they are redirected to the Petco page with some advertisements on current deals that they have in the pipeline.

And then we also added some location analytics there, so you can see where people are going in the store, where they're spending their time, what route they're taking to get through the store, how long they're spending in particular sections of the store, and again, this helps the customer figure out how to rearrange their store, put up different signage, change the layout, to get better results from their customer. We have path analysis, we have dwell-time analytics, we have counts. So, obviously, there's a lot of different Petco stores, so you can compare the numbers between the different sites and things of that nature.

Alrighty, thank you guys for joining us. We have some contact details up here, if you'd like to reach out to us afterwards, and then I think I'm handing it back to Lilian for Q&A.

Lilian Veras

Excellent. Thanks to both of you, Tyler and Mehran, for such a great presentation and sharing such great information with us. We do have a few questions that have come in while you were presenting, so let's get started on questions.

The first question we have here is, what is unique about automation for this type of Edge application?

Mehran Hadipour

So, let me take that one. So, there's actually three distinct things that are unique requirements for this type of workload for automation. One is the challenge with the scale with many of these deployments. You're talking about a large number of nodes that have to be managed and orchestrated. Second is that those nodes are usually deployed at remote locations, but with very little IT support. And you can't count on on-site services to be able to manage them. And lastly, there are required things outside of the common infrastructure to manage. For example, we're not just talking about servers and operating systems here. We're talking about IoT devices, cameras, and

anything that has very limited manageability outside of the way they're deployed. So, whatever we use for orchestration and operation needs to be able to manage things at scale and things that are not really network functions and operating systems, and that's what we build MDCAP to be able to manage IoT devices or cameras, or sensors, or whatever that is placed as an element. Anything to MDCAP is an element and those elements can be managed on-demand. I hope I answered that question.

Lilian Veras

Excellent. Thank you, Mehran. There is another question here for you. How will Robin scale for use cases like IOT where we have a very large number of devices with little processing power, like sensors and cameras?

Mehran Hadipour

Well, that's a good question. As I mentioned, the manageability of different devices, including IoT elements, are also an important part of making sure the service is available. So, MDCAP, within MDCAP you can create an inventory profile for a specific component, let's say a Wi-Fi node, or an IoT video-enabled camera, or a small sensor, and for each of those hardware profiles, you will define what elements could be managed. This allows you to build a workflow for automation, and instantiation, and lifecycle operations that are tied to specific elements. So, you can not only manage a server and software and components that are present at the Far Edge. You can also manage the specific elements for availability and updates, or instantiation as well, including things like cameras or IoT devices. Thank you.

Lilian Veras

Great, thank you, Mehran. A member from the audience says that he's getting ready to reopen and bring folks back to the office. What steps should he take to make sure the environment is safe and productive for his employees?

Tyler Manning

Yeah, great question, I'll take that one. And there's really a lot of different answers to this question, and it's unique to the circumstances and the employer. One of the things you want to look at is, what are your employees thinking? It's really an interactive conversation with them. Are they prioritizing access more? Are they wanting to work remote more? Flexibility, is that a big issue? Safety, is that a high concern for your employees? So, again, really, it's a collaborative conversation with your employees, and once you sort those details out, there's a lot of different things that you can do, a lot of different directions you can take this, from implementing hot desking/hoteling systems that allow people to book desks, if employees are no longer going to have their own personal space, and you're downsizing your corporate real estate footprint. This can look like implementing health questionnaires to make sure that people that are coming on-site aren't sick and are not going to risk infection to other employees. This can look like implementing contact tracing to make sure that if something bad does happen, you have a system in place to handle that. This can look like adding cameras on-site to make sure people are wearing masks when they're on-site, if that's a policy that you have. Implementing location analytics so you understand where people are grouping, and hopefully, they're not grouping too much. Again, there's a lot of different things you can do here, and the most important thing is to talk with your team, talk with your employees, figure out what's best for you and your company to implement, and feel free to talk to us as well. We've seen a lot of different approaches, a lot of different things from different folks, so we can help guide that process.

Lilian Veras

That's great, thank you, Tyler. We do have time for one last question. A member from the audience says that he would like to use our digital signage to share metrics across global offices, things like ServiceNow, ticket updates, and Salesforce customer wins. How can he deploy with Robin and Kloudspot to manage all of this globally?

Tyler Manning

Yeah, great question. I'll take that one again. So, with Robin and Kloudspot, when you bring the two of us into something, Robin is there to help manage the rollout of the hardware, the Edge devices, making sure that process is very easy, very manageable, and doesn't create a lot of work. And they're on the hardware, the IoT side of that, and then we as Kloudspot are on the software side of that. So, we're integrating with all the signs, all the TVs, and integrating with your application. So, if you're interested in ServiceNow, Salesforce, or if you're interested in Tableau in JIRA, we can integrate with these applications. We can put them up on the screens that you want to put that information up on, and we open up a portal for you to manage the content on all of your screens, wherever they are in the world, from wherever you are in the world, and we make that process very easy.

Lilian Veras

Thank you both, again, for such a great presentation. Thanks to our live audience for joining us today. Please do not forget to give our team a rating for the live recording so that we may continuously improve the quality of our webinars. This concludes our webcast. Bye for now.

Mehran Hadipour

Thank you so much.

Tyler Manning

Thanks.