



## For Cloud Professionals, part of the On Cloud Podcast

**David Linthicum, Managing Director, Chief Cloud Strategy Officer, Deloitte Consulting LLP**

**Title:** Building a hyper-connected future with cloud, edge, ML, and 5G

**Description:** Cloud, edge computing, and machine learning (ML) are radically changing the way people interact with technology. The advent of 5G—with its ability to drastically reduce latency—will speed the pace of change almost unimaginably, and it can enable humans and technology to interact in near symbiosis. In this episode of the podcast, David Linthicum and guests, Deloitte's Ashwin Patil and Cloudera's Michael Ger, discuss the changes and challenges ahead for cloud, edge, and ML and how—coupled with 5G—those changes will likely bring about a profound transformation in how technology is integrated into our lives.

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**Operator:**

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**David Linthicum:**

Hey, guys welcome back to the On Cloud podcast, your one place to find out how to make cloud computing work for your enterprise. This is an objective discussion with industry thought leaders who provide their own unique perspective around the pragmatic use of cloud-based technology. On the show today, we have Michael Ger and Ashwin Patil. Ashwin leads the data analytics and cognitive for manufacturing and AHS sectors with over 20 years of experience helping clients achieve actionable business value intelligence through data. Michael Ger serves as the general manager of manufacturing in automotive industries at Cloudera. Mike is responsible for driving the solution vision go-to-market strategies within each industry segment and works with industry leaders to drive next generation business insights through big data analytics. So I've got the big data guys on the pod today. Is that right, Ashwin?

**Ashwin Patil:**

Thank you, David. That's absolutely right.

**David Linthicum:**

All right, so what do you guys do during the day? In other words, I see your very impressive bios here, but what's the day in the life of Michael like and what's the day in the life of Ashwin like? Michael, you go first.

**Michael Ger:**

Yes. Well, speaking on behalf of Michael, myself, I work at Cloudera. I'm the General Manager of Manufacturing and Automotive here. My job is helping clients understand how big data technologies can be used in the areas of manufacturing or automotive. So while it's a horizontal technology, how do we verticalize it and actually create solutions that are relevant to the manufacturing and automotive industry?

**David Linthicum:**

Great. And, Ashwin, what do you do at Deloitte?

**Ashwin Patil:**

So at Deloitte, I focus on helping our clients think through and vision the future as it pertains to technology from a data and analytics perspective, think about sustainability as they adopt these technologies and drive it across the organization, and as part of that, I get to play with a whole bunch of cool technology all day long.

**David Linthicum:**

So what is going on in the world of big data these days? And if you look at the last couple years, of course, there's been significant strides certainly, movement to cloud, the ability to integrate cognitive computing, things like that. So just put you on the spot here, what are kind of the three trends that you see as kind of really kind of innovating the industry right now? Michael, I'd love to hear from you first.

**Michael Ger:**

Absolutely. So, first of all, I think when we look at data, there's obviously the advent of a lot more real time data that's being used in companies' operations and stream processing. So companies are actually making decisions in real time. I want people to think about just big data and machine learning, kind of thinking about it as a data life cycle. When you actually have to deal with big data in terms of making real time decisioning, the key point is to be able to ingest that data very efficiently, store histories of that data – once you've ingested it, store it in a data lake, so that it can be used for machine learning.

So you can store it, for example, if you're talking about mobility, which sensor values correlated to the need for maintenance on cars over time, and understanding that, and then once you understand that, you can deploy those models out to the edge, which is another trend. And once that model's deployed on the edge, now you can listen in real time for those characteristics that dictated whether or not maintenance was needed, and you can take a real time action, like send out a service appointment to the customer. So the big trends are edge computing, the collection of big data itself and using it for machine learning, then deploying those models back out to the edge. And that's going to allow for a lot more dynamic real time actioning in our society as we go forward.

**David Linthicum:**

So, Ashwin, same question. What do you think the big trends are in the last couple years?

**Ashwin Patil:**

So I think what Michael touched on is an important aspect. I mean, if you think about the value of data and analytics, it's really in getting to that decision that someone has to make, or something has to make as quickly, as efficiently, and with as much data as possible, to make it accurate. When you think about it from the standpoint of that action that needs to be taken, you can really think of analytics value in three horizons. The first horizon is what we used to operate in the past where reporting and things like that for batch-oriented. It's all about providing that consistent intelligence. As you move to that second horizon, which is largely where most companies we see are today, which is augmented intelligence, which is, I cannot only look at historical trends, but I can also think about what, potentially, is the right answer and is the right decision to be taken and provide that as an initial starting point for my analysts, for my business users to go act upon.

And what we are headed towards is this current horizon of automated intelligence, and this is where it's really exciting because you're moving towards a low latency, high real time data usage, and thinking about areas like edge computing and so on, that's going to dynamically transform the way decisions are being taken but driving a heavy amount of automation in those decisions itself. And that to me is really exciting because 5G and some of these technologies that are out there today are getting us to that point.

**David Linthicum:**

Now, getting into edge computing, this is something I've been writing and talking about for the last couple years, and it seems to be an architectural challenge. We have to kind of figure out how to balance some of the processing that occurs within the centralized system, sometimes most of cloud based these days, and what we're pushing out to the edge. Obviously, we have to do the things that are able to react to the data that's coming into the edge-based device instantaneously. I always use the analogy of you want an edge device to operate in a disconnected fashion, for example, if it's monitoring a jet engine that you happen to be aboard. And, however, you do want it to communicate back statistics around maintenance, so you can kind of have a crowd sourcing kind of thing with an AI engine bolted onto it to understand where the maintenance is going to occur and what needs to occur and what may be leading up to a failure. All those sorts of things are possible these days. So, Mike, I'll go to you. What's your definition of the edge and what are some of the big opportunities for businesses out there?

**Michael Ger:**

So the definition of the edge, I think, is obviously as close to the sensor as possible. And we're seeing a few interesting trends. We're seeing the edge becoming more intelligent. I've done work with the company, NXP, who makes gateways that sit on the core, the communication gateways in the core. Interestingly, those gateways are getting more and more intelligent right now. So they've got their own storage, they've got their own memory, so they're moving more toward the ability to execute services on the edge itself. , 5G is saying, you know what, I don't have to do as many things on the edge for latency concerns. So since I can move data very quickly, I can actually execute on the cloud and still have a reasonable latency. You bring up the great point,

though, however, in terms of mission critical things where you can't risk losing that network connection, you still want to be able to execute those applications on the edge.

Now, one of the things that can be used – that you mentioned to kind of bridge that is the fact that if you've got something on the edge, you mentioned the maintenance use case. You have to be able to collect on the edge, one of the things we can do and some of the technologies we bring to bear here at Cloudera is the ability to queue that data, data on the edge, and then once a connection is reestablished, then push it over into the cloud. So there's some mitigation strategies to accommodate that scenario where you lose your connection. But, interesting, two trends: the cloud's getting bigger and more efficient, 5G's making it less important from a latency perspective to do things on the edge. You can do things more in the cloud right now. Depending on the business application will depend ultimately whether workloads are done on the edge or on the cloud.

**David Linthicum:**

So, Ashwin, obviously 5G's coming. It's not here yet, at least in certain pockets of the country. I've seen demonstrations, things like that. Are we building out more complex architectures by moving things to edge-based devices and operating in a disconnected low bandwidth world when the world's going to be highly connected and high bandwidth coming up where the edge-based devices will become obsolete?

**Ashwin Patil:**

So I don't think the edge devices are going to get obsolete because in the way Michael explained it is absolutely right. The realm of edge is evolving. The traditional thinking around edge was I've got a sensor, that sensor's triggering some information, somebody's got to act on that information, and it's connected to the asset that the sensor's on. The realm of edge is evolving to the point that we're not just talking about asset-based decision making. We're talking of asset-to-asset based decision making where assets are talking to each other without always necessarily going to a cloud or without always transferring information to some form of a base.

And that's, again, an evolution where edge is going to continue to evolve there. When you think about autonomous cars in the future and the way people are talking about what is that infrastructure that will need to exist to support autonomous driving. 5G is an important aspect in that because it allows you for making those low latency decisions, the typical human decision or 4G decision in the past, 200 milliseconds, for any reaction to happen. With 5G, we're talking a millisecond for that same decision to be taken, of that same amount of information to be transferred. You're talking 200 times faster than what has ever been possible before. What that will do is allow assets to not only make decisions on edge by themselves, but also interact with other assets in the ecosystem that it's connected to, as well as broadly across the globe because of the expansion of cloud, like Michael explained.

**David Linthicum:**

So in other words, if we have enhanced bandwidth and always going to be connected, things like that, we can not only reach back to the central computer, but engage all the other edge devices in making a decision based on information that's coming back on those devices in real time. Did I about get it, Michael?

**Michael Ger:**

Yeah, I think you got it exactly right. And again, I think the one thing for the mission critical things, the driving of the car, which direction, the decision making that has to be made that turn the wheels of the car in terms of the steering wheel, those types of conditions, those types of use cases ultimately you will do on the edge, because you simply cannot risk that connection going down. Short of those use cases, I think there will be a trend, given the latency advances that we're seeing here is that other workloads and decision making can be made more centrally on the cloud.

**David Linthicum:**

So going forward, how will edge computing impact our lives, how will 5G impact our lives, how will mobility impact our lives? So what's going to change for the average consumer over the next two or three years? Ashwin, why don't you take that one?

**Ashwin Patil:**

Yeah, sure, Michael. It's funny because I live in one of the Dallas suburbs. I'm about 40 miles from the Dallas downtown where the Deloitte office is located. On an average day, it takes me over an hour in traffic to get to the office. A practical usage of edge and 5G when cars do start driving autonomous and start able to make decisions on a near real time basis, is not only to be able to get to the office without ever having to touch the steering wheel, but to be able to do that in a third or a fourth of the time that it takes me today.

I'm not excited as much about autonomous driving, which takes me two hours longer. I'm excited about autonomous driving where I can get in my car and my car drives 200 miles an hour to the office because it's connected with everything else. It's connected with the road, it's connected with the other cars, it's connected with the lights, it's connected with the entire infrastructure that takes it from here to there. So to me, those are the kind of things that really excite me, because the ability for devices to act intelligently in near real time, not only for themselves, but to be able to transmit that information to the broader ecosystem and, through areas like cloud, make the overall ecosystem smarter is what's going to drive the future.

**David Linthicum:**

So, Michael, what do you see? What's another example?

**Michael Ger:**

I think Ashwin's example is amazing, and I think while that car is driving down the road, it's also the interaction with the surroundings, and not just the surroundings that drive the car, in terms of location-based commerce. As I'm entering into certain areas where, for example, getting personalized offers from vendors in that area. You see that the ecosystem will grow beyond just getting me from Point A to Point B. We're bringing in commerce, you're bringing in government agencies that might be able to tell you that you're entering into a dangerous zone, and the list goes on and on and on. So it's not only a better transportation experience; it's a much fuller experience because you're bringing in different connected communities as well.

**David Linthicum:**

So this is going to impact the majority of our lives, considering that everybody's carrying phones. Those phones typically are low bandwidth devices as of now. They're going to become high bandwidth devices, and therefore the potential of us doing wonderful things with our devices is there. We just had a couple of examples. What would be some of the downsides or concerns around the rise of mobility and 5G?

**Ashwin Patil:**

In my mind, David, one of the big advantages that 5G gives you also has a disadvantage. Going into a little bit into the technology aspect of things, the reason we are able to connect a lot more number of devices to a 5G transmitter, and the reason we are able to see speeds of interaction that are that high is the way that wave is transmitted. You're talking a millimeter wave that has a high frequency. High frequency has a downfall, though, which is it doesn't go over long distances. And to me, that's going to be the sort of the need that's going to drive toward a 6G in the future.

There are certain organizations and countries that are already investing in what potentially 6G should consider that currently are potential drawbacks of 5G. So to me, I see that evolution happening, but to me, the need for the 6G is largely driven when you are starting to go outside of urban zones, when you're starting to think about how you continue transmitting data. 4G today is a lot more efficient transmitting data over long distances than 5G is. So at the moment, you get outside of urban circles where you've got a lot of transmitters in it, you're going to need 4G or something better than 5G.

**David Linthicum:**

So talk about 6G. Michael, what's next after 5G? Where are we going?

**Michael Ger:**

Well, first of all, I think if you look at 5G just for a second, there's going to be an evolution there as well, as Ashwin mentioned. There's going to be playing with the frequency levels, and I think there's a lot of optimization that could be done within 5G. Beyond 6G, it sounds to me like Ashwin's got a lot better handle on that than I do, but I think what I'm very excited about on the 5G front is the fact that I think, once you're connecting people so dynamically and you can interact with them in such real time, it's really the bringing in of that connected community that I think is going to change a lot of people's lives in terms of new services, new data, and I think just reimagining the way people live their life from when they wake up or go to bed.

**David Linthicum:**

Yeah, we're talking about changes in society as well, certainly segments of the country. Obviously we have bandwidth deserts out there where people just don't have access to high-speed internet connections, and those will be changed when 5G comes along. Suddenly it'll open up those worlds and they'll have access to cloud services, web-based services beyond dial-up that people are actually using today, things like that. And so the ability to drive a career based on those connections, the ability to kind of work at home and raise the income and kind of raise the lifestyle or the livability of these areas, like Appalachia and a few other places in the country. That's going to be a real change. How quickly do you think that's going to come along and how are we going to measure the impact of that? Ashwin, I'll go ahead and throw that one to you.

**Ashwin Patil:**

Yeah. So like I was saying before, one of the drawbacks of 5G is you require a lot of transmitters because the waves don't go that far. So as you start thinking of remote areas, I feel like before 5G gets to remote areas, we are probably going to see 6G. If I have to look into a crystal ball and kind of draw a time horizon, in my opinion, 5G is going to be the dominant way in which data is transferred wirelessly over the next ten years. I feel like, with where we are today – and again, this is kind of to Michael's point, that will require some optimization and reconfiguration of existing infrastructure, including, for that matter, what Michael was talking about from a transfer to the cloud standpoint.

Because as the number of devices that get connected within the network of assets increases, it's going to require a much higher throughput than cloud has ever seen before. So you're talking of the billions and billions of potential devices, or smart devices, that have some form of a sensor transmitting data. And the question's going to be how much of that data gets transmitted, how much of that data stays on the edge, how much of that data is used for broader intelligence where there's a specific need. And to me, that's going to continue to evolve over the next ten years before we see the next generation of wireless technology coming in and driving and closing some of the issues that, currently, the combination of 4G and 5G will continue to face.

**David Linthicum:**

So, Michael, what are your thoughts on this?

**Michael Ger:**

You know, just – I agree. I think Ashwin's points are amazing, and, one of the things that we're doing, the types of technology we bring to bear is we deal with what we call data in motion, which in this context means moving data from the edge to the cloud and back, but also data at rest where you actually – the data's sitting and you could do analytics on things like that as well. Now, interestingly, one of the things we see as a critical piece of this is that, at the edge, when you're talking about getting data from the edge to the cloud, as I mentioned to you earlier, you need to – we've got enhanced capabilities to buffer that data if you lose your connection.

You also have the ability to set up rules that determine prioritization of data that gets transmitted because emergency data should take priority over data that just is capturing how customers are using their cars, for example. So this whole optimization of the edge and edge to cloud and bringing up latency concerns, bringing up safety concerns, bringing up prioritization of data concerns, we now have the technology to be able to make that edge and make those decisions and have a rules engine that is going to allow optimization of that. Because, as Ashwin said the good news is that we can move data very quickly. The bad news and the challenge for the cloud now is, is cloud going to be up to processing all of this data all of the time. And there's going to have to be some intelligence in-between that that says what is the most important, what do we want to prioritize? And the good news is that there are technologies now that can dynamically, through a set of rules, control that flow of data.

**David Linthicum:**

Yeah, that's excellent. That's excellent predictability of where this technology can take us and also what we need to do. Like you mentioned, we have to figure out not only the buffering technology, but how we're going to balance the processing, and if we should balance the processing. It becomes sort of an architectural challenge that we're going to have to meet as technologists. So if you enjoyed this podcast, make sure to like and subscribe on iTunes or wherever you get your podcasts. Also check our past podcasts, including the On Cloud podcast hosted by Mike Kavis on his show, Architecting the Cloud. If

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**Operator:**

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