Paul T.: Thank you for tuning-in. My name is Paul T. I'm your host for the If/When Podcast Series. And today we're talking with several of Jacob's data center subject matter experts about their new design concept for cloud condos, which brings together the best of both hyper-scale and colocation data [00:00:30] center design. This plug and play concept offers both flexibility and scalability while maximizing speed to market for data center clients.

Our guests today are Kenneth Kutsmeda, Global Technology Leader for Jacobs mission critical. Paul D'Onofrio, Discipline Lead Architecture, Jacobs. And David Seger, Senior Mechanical Engineer mission critical technologists, Jacobs. Ken, Dave, and Paul will walk us through the market developments and design innovations that drove this new approach. [00:01:00] So, Paul, let me start with you. What is a hyper-scale data center?

Paul D'Onofrio: Thanks, Paul. So well in order to truly understand hyper-scale, I think we need to briefly review some of the common types of other data centers that are out there. And the three that I'd like to talk about today include enterprise data centers, colocation data centers, and of course, hyper-scale data centers.

First enterprise data centers. So this is a facility that's owned and operated by the company. It supports and [00:01:30] really used solely for the company's own purposes. These are usually constructed at a company site and located either as a standalone building, whereas a part of a building with are non-related program spaces like offices. An example of an enterprise data center owner would be a large financial institution where they can have total control over all aspects of the data center, including the physical security of the data center and it's stored data within.

[00:02:00] The next site type of data center is a colocation data center. And it's common referred to as a colo. This is a facility that's owned and operated by one data center owner who as any typical landlord tenant situation sort of sells or rent space, power, and cooling to multiple customers in one specific location. In this scenario, tenants, they have little control over any infrastructure beyond the area of IT rack space that they buy or lease from the facility's owner [00:02:30] and colo IT space is usually found in cage configurations with an open server hall along with other adjacent tenants. And they all share the same power and cooling systems. Examples of colo tenants are smaller to medium sized businesses that don't necessarily want to build and maintain a space to computing at or within their own facilities.

It's not uncommon for these companies... But it's not uncommon for companies who own enterprise or hyper-scale data centers to also purchase colo space for themselves in order to supplement their own data center [00:03:00] assets. But as we'll get into that in a little bit more detail later.

Paul T.: Okay.

Paul D'Onofrio: So that would bring us to our third data center type. And of course that is hyper-scale data center. And hyper-scale computing is that which is really necessary for the cloud and big data storage to occur. And therefore a hyper-scale data centers are owned and operated by the company that it supports. And examples of such hyper-scale data center proprietors that people are probably most familiar with include companies [00:03:30] like Amazon, Facebook, and Apple. Google, and Microsoft are also in this group of hyper-scale data centers. So in the simplest of terms, Paul, a hyper-scale data center is a really big data center.

However, they still do come in a wide variety of configurations and sizes and hyper-scale facilities, they typically start around 10,000 square feet for the data halls and about 500 cabinets also commonly known as racks and numbers only [00:04:00] go up from there. Quite significantly higher in some facilities. Other aspects typically associated with a hyper-scale data center are a robust redundancy of systems N plus one, N plus two, or even two N for some systems, they're highly scalable and expandable. And they're usually outfitted the high fiber count and an ultra high speed network. So as it relates to cloud condos, which we will be getting into a little bit more detail shortly, I really think the colo and hyper-scale [00:04:30] data models are the ones that will most be applicable to our discussion today.

Paul T.: Okay. And then Ken, so let me ask you why are hyper-scale clients considering in colocation? What's in it for them?

Kenneth Kutsmed...: So, Paul, I think prior to COVID-19, the online traffic within that cloud space. It was really projected quadruple by the end of 2021. And then COVID-19 hit and we saw that radical shift between business and social online behavior. People started to work online [00:05:00] more. They went to school online, shopping, and even socialization now is done all online. Everybody's in a Team meeting. And when you look at that, that cloud traffic is just continuing to grow every day. And then so even after the pandemic is finally over, we believe that that online behavior will continue and things are just not going to go back to the way they were before COVID. So the hyper-scale clients are really trying to keep up with that ever increasing compute demand, and they need that extra data center capacity. The problem [00:05:30] really is that the hyper-scale, the large hyper-scale facilities that they're used to take time to build. You got to go through site due diligence, you got the land acquisition, you got to get the utility infrastructure, all that can take months or even a year.

So the hyper-scale clients are really looking at colocation for immediate help. The colocations generally have the land, the utility infrastructure already in place. So that'll really help speed up that process and help get them the data center capacity that they need much quicker. [00:06:00] Some other things that they're looking at the hyper-scale clients are looking to colocation for that global reach, to be able to get into those new and emerging markets, maybe non-traditional markets that they're not in already. And it's specifically in those areas of the world where they don't do business, they don't have the contacts,

they're not familiar with the procedures, the governments, and so forth. So those types of things can really help. And the colocation also offers the flexibility so they can go into those markets, they can test [00:06:30] them, and then if they want, they could switch between markets as that online activity shifts between regions.

Paul T.: Okay. And then Dave, so Paul, mentioned earlier this thing, cloud condo, and that might be a new term for some folks. I know prior to our talk today, I hadn't heard much about that. But it sounds like a fascinating concept. Can you tell us a little bit about what is cloud condo?

David Seger: Yeah, sure. Well, I can tell you, [00:07:00] it's not a residence at the top of the latest high rise. The cloud, Ken, talked to about was probably is a reference to the data center infrastructure that supports the systems out there that we're using, now especially, with a lot of remote working, which became very rapidly growing market. And so that's where the cloud came from. The condo as you [inaudible 00:07:23] we took that from real estate. Basically, if you consider a standard colocation facility to be similar [00:07:30] to an apartment complex, it's being made up of smaller, sometimes not so private areas, but they mostly share their amenities. And then the enterprise data centers that, Paul, talked about, they're more like standalone homes with large private areas, dedicated amenities. And the hyper-scale is the subset of that, basically states or mansions.

So the condo is between the two, which we have larger private areas, mostly dedicated amenities, [00:08:00] a few that are shared, for instance, condominium many times, there's hallway is shared, but everything else is secured and private. So the cloud condo with that, the Jacob's team took a look at providing an option for those data center users who need the dedicated space, need the dedicated mechanical electrical systems. And either they don't have the time. Maybe they don't have the resources that the moment or the need to execute a full scale estate data center. So that's where the term cloud condo came from.

Paul T.: OK. And then so [00:08:30] how is cloud condo designed different from say a traditional colocation data center?

David Seger: Sure. As I mentioned, many of the traditional colocations or designed for small areas like an apartment, smaller areas. Then are typically desired by the hyper-scale users, they need less power, less cooling, less space. Colocations; so they share those systems for the economies. They segregate in smaller increments. Some are to a server within a cabinet, sometimes it's by a cabinet, or a small [00:09:00] group of cabinets. Caged areas occasionally you'll see a walled-off areas, but usually it's into a caged area. And that's the colo. And then we're looking at the hyper-scale, they're looking, as I said, larger deployments, very secure, dedicated power. They don't want to share systems. They wanted to share the backup systems. Physical separation for security and fire

departmentalization. And that kind of thing. Ken, you've looked in this a little bit too also. You have some commentary?

Kenneth Kutsmed...: Yeah. I think [00:09:30] like you said, it's really, when you look at a colocation, the electrical systems are shared, the redundancies are shared. So if we had a power outage, certain people may get their redundancy. Where the cloud condo is, it's your redundancy. It's the specific client's redundancy. It's not shared. Same with mechanical systems. And mechanical systems are theirs. They're not shared. So they have control over that. And like Dave said, that the apartment or dormitories that work, you're just putting a lot of different people in the same space. [00:10:00] The cloud kind of gives you that security and fire protection that you're looking for.

Paul T.: Okay. So, Paul, let me ask you, what are the advantages of using the cloud condo design concept?

Paul D'Onofrio: So, Paul, a lot of it is exactly what, Ken and Dave, have talked about when they were describing the cloud condos. So cloud condo space is available to customer in larger capacity blocks. The server hall spaces that [00:10:30] we've kind of set a design at about a five megawatt module with independent power and cooling systems to support each module. This is opposed to that limited power capabilities and shared power and cooling offered in the colo or environment. These blocks are scalable. So in that a client may opt for more than one block of five megawatts at a time. And right now we have it kind of configured to where we could go up to 30 megawatts in a single building and increments of five megawatts. And [00:11:00] as a single story configuration, that was a speed to market decision.

But because again, lower story, one story, buildings are faster.to construct than 10 story buildings. But we could certainly, we do have options to scale it up to multi-story if a client needed to do so. And a lot of times that would be a site specific, a smaller site where you don't have an expensive ground you'd want to go higher. The modules are, as again as [00:11:30] Ken and Dave alluded to, are configured as separate and individual IT spaces, as opposed to shared space. This provides that physical separation from other customers. There's a lot of proprietary equipment and technologies that each of these customers develop on their own. And they don't typically want to see that. As well as a lot of times they're dedicated their utility infrastructure, their power and cooling. A lot of these companies come up with their own ways of doing things and they prefer to keep that to themselves. [00:12:00] And it's things that they can't typically deploy in a colo environment.

So it really, it gives them much more control, a client, much more control of the setup of their physical operations of their space and gives additional benefit as, Ken, also alluded to the fire partitions between different client spaces to protect their property. You are in a colo situation where you have the cages and your level of physical security is at the cage. They have to be open to allow for the

airflow. So again, you don't get the visual security, [00:12:30] but also you're relying on all of the other customers' due diligence when it comes to their protocols for keeping their equipment safe and hazard free. So again, this takes that away as a risk for clients.

And I'll ultimately the cloud condo provides a greater offer for flexibility and offerings for customizations to the specific needs of an individual client. And then [00:13:00] also, I think a really big one to just reiterate again, is that speed to market as, Ken, alluded to. It takes a long time to build a hyper-scale data centers. These are large facilities. And finding a site and performing the due diligence, negotiating with the utility companies, and authorities for the considerable amount of power and water needed, that all has to happen even typically before you even start the design of the building, let alone the construction. So really [00:13:30] these benefits we think really are sort of the assets to kind of pursuing or looking at a cloud condo idea.

Paul T.: Okay. And then, can you describe, for our listeners, the cloud condo layout and architectural considerations that went into the design?

Paul D'Onofrio: Sure, absolutely. So, our goal was to design the building using a modular approach for both the building program and the physical structure and one that could be repeated. It also needed [00:14:00] to be flexible enough to accommodate an individual client's needs and to a degree anticipate future unknowns. So for the buildings program and physical characteristic, the baseline design is that single story, again, to help with speed to market, again, but with also the option to go multistory in order to accommodate those smaller sites. And as I mentioned earlier, we wanted to provide the separated server halls and infrastructure that could be dedicated to a single client. [00:14:30] We wanted to include the... And with those kind of standalone modules, they could fit out the space exactly to their liking.

And so we included such things like sort of the POEs or points of entries. This is where the fiber enters the building in each module. So each module has the ability to accommodate an independent entry point. Where in a colo, they typically come in through a single room, it's a shared space. They don't all have to be used, but it's an option for clients [00:15:00] to use that. Circulation through the building, such that you don't pass through other customer spaces like you do in a colo environment and common service air areas that we call the head house, sort of, this is the administrative and logistics area. These front spaces could be shared, or they can also be configured to be somewhat to give a degree of separation and privacy to a particular client. So, a client can actually get a good portion of one of these buildings and almost [00:15:30] act like a hyper-scale data center for them. While another portion of the building could get distributed amongst other clients.

So for the first and for the server hall in the white space, we developed that module, that five megawatt IT computing capacity module that had mentioned

before. We wanted this block to allow for scalability to accommodate the various rack entities that come in the IT industry. [00:16:00] If you have a higher amount of power draw at the rack, you'll need less racks to make up that five megawatts. So what we wanted to be, we wanted to... So by using a repeating structural grid, in all these areas of the building, we wanted that IT space to have the potential to be retooled and service either mechanical or electrical space in some way, or vice versa, more IT, depending. So that was, and I'll get into the building structure in a bit, but that was really the idea of that scaler modularity [00:16:30] repeating system.

We wanted to allow the power to accommodate the dedicated power and cooling as, Dave, mentioned earlier. But they'll give more detail on that. And as I mentioned, the fire separation of physical security, which are really important to these clients and give them that sort of ability to either a self performed fit out. Or in some cases, they could have a full service turnkey deployment if they chose sort of the baseline design systems [00:17:00] that we've developed.

So, ultimately, all these self-contained five megawatt modules can be scaled up to a day in a 30 megawatts and it is typically when the facility is completely completed. So six modules along with that common head-house, and they can be shared and divided into levels of privacy at the administrative and logistics side. And again, we also can explore increasing those capacities in a single building shell.

For the building shell, [00:17:30] we looked at the three options for building shells that we see as typical for the industry. Those are pre-engineered metal buildings, wide frame steel building frames, and precast concrete. And all of those could typically go on a slab on grade. And so what we wanted to do is we wanted to establish a structural grid that was both optimal and flexible to accommodate the variety of server hall configurations, but also accommodate the three different building shell systems that I just described.

[00:18:00] So first we looked to optimize the building structural grid layout, and optimum and repeatable structural bays that would accommodate the different layouts of IT racks and hot aisle containment. That modular building design and construction, structural bays with longer beam spans to provide greater flexibility for equipment layouts. We wanted to eliminate the columns within the server halls, really to minimize loss of rack positions. Again, they are repeated rows. And so any interruptions is just something we think it would [00:18:30] be nice to design out. And we found that 60 feet is a typical span. That was good. That would work with those three building systems. And it's also the 60 feet is a good size for a structural member, that to be transported overland, as single members. And that sort of promotes faster or installation in the building.

And then one more characteristic on the architectural side, but also that we felt we needed to really include in this design; in the event is that the cloud condo

[00:19:00] owner decided to revert the facility back to a traditional colo business model. So this can certainly be done with the cloud condo design without having to do a whole sale retooling or renovations or modifications of the primary building shell. And therefore they could go back to those shared server halls and sharing power and cooling systems if necessary.

Paul T.: Okay. And then, Ken, let's peel this back just a little bit further. So what makes the electrical systems unique?

Kenneth Kutsmed...: [00:19:30] Paul, I think the one thing that's unique about the electrical system is the configuration of the equipment. Oftentimes with data centers, the electrical is the last trade to begin work. They're always waiting for the building to be complete before they can install and connect the equipment. So with the cloud condo design, we kind of packaged and skid mounted all the major equipment and moved it outside, outdoors. So this way it could really be fabricated, connected, tested, even installed all before the building is even constructed or during the building construction. [00:20:00] And we really tried to minimize those connections from the outdoor to indoor equipment. And we tried to standardize. Utilizing standard components try not to be very unique component to help reduce that construction time.

I think another unique aspect is the flexibility of the plug and play design. And when you look at electrical systems, it's really dependent on what's available and the sizing of the equipment and different regions of the world. You go into certain regions where you can't get a three megawatt [00:20:30] generator. You're limited to an 1800 KW generator. So your design needs to adjust. So the cloud condo design, we broke up the equipment into individual power-trains, and that allows us to adapt to those differences in equipment sizes. The power-train also allows us to, if we have a client that wants added redundancy, you could add on extra components to really increase that level of availability.

Some of the other thing is because the equipment's [00:21:00] outside, we can really adapt to the different client needs. So if a client uses batteries in their racks and doesn't necessarily have a central UPS, we can eliminate that from the design and it doesn't affect the overall footprint of the building. And we're not wasting space within the building because we had that space identified and then it wasn't used.

As Paul mentioned, and I think Dave well too, is hyper-scale clients have really spent a lot of time on their base designs. So they know what they want. They have [00:21:30] power system configurations that they feel comfortable with. And one of the advantages of the cloud condo is the electrical systems are really independent. So if that client has a system or configuration that they like, they can actually bring that and just plug it into our design. And allows them to utilize their designs if they want to.

Paul T.: And then, I mean, with a data center like this, I imagine it's just an incredible amount of power needs to go into it, and [00:22:00] of course that generates a lot of heat and you have these sensitive systems. And so the data centers I've been in they're very cold, they're very temperature manage. So Dave, can you explain, with the cloud condo setup, explain the flexibility of the mechanical cooling systems and what considerations drove their design?

David Seger: Certainly. Yeah, data centers, some of them do run cold. Some of them actually run warm. There's a wide variety. [00:22:30] When we started looking at this as Jacob's design team started, I was asked that question, "Well, what kind of cooling systems should we use?" And I provided the most accurate answer that anyone could possibly provide, which was that, well, that depends. As you can imagine, the mechanical systems really depended upon the climate it's going into. And so where is it going to be located? What's the availability of water, what's the quality of the water that's available? [00:23:00] We should look at sustainability issues around water use, the amount we're using, the need to worry about airborne molecular contamination, pollution outside can come in to... High humidity situation could come in and cause corrosion in IT gear. There's also other exposure such as extreme cold conditions, dust storms, and the list goes on and on. And the reply I got back was of course as accurate was, "Well, that depends."

So mechanical, we had a wide open canvas [00:23:30] and when we're considering all these site specific elements, picking a single cooling solution would necessitate making some compromises. But what criteria should be weighted heavier than others is sometimes it's a little bit dependent upon who's going to occupy this space. So in creating the cloud condo, rather than finding the best compromise that we thought was the best compromise, we looked into developing an overall data center configuration that would support multiple mechanical solutions and enable us to [00:24:00] select the system that's tailored to the client and the climate, the data centers. So basically the Jacobs design team used a holistic approach that allows us to deploy in this facility either a direct or indirect outside air colonization, standard crawl units with air cooled or water cooled economizers with, or without, excuse me, water cool chillers with or without economizers. And we could also applied various evaporation cooling techniques. This was all done with the goal to [00:24:30] allow us to do this quickly with minimal impacts to the architectural electrical systems.

So the mechanical equipment is of course selected to meet the cooling needs, as you mentioned, we got to keep it within the criteria. But furthermore, we looked at the electrical systems and the mechanical redundancies and the size of the mechanical equipment and how the backup and the switching should happen. And we sized the system such that we minimize the amount of what I'll call stranded electrical capacity there is. This is electrical capacity that we need [00:25:00] in a backup situation that's unused normally. Well, we want to minimize that, that's wasted overhead. So we took a careful look at what

equipment we can switch over and how we provide that backup. And architecturally, as I said, the system is designed so the mechanical systems have access to the space to access the external environment without needing to impact the location of the electrical systems or the distribution of this systems. And we maintain separation [00:25:30] between the mechanical electrical maintenance activities also from the IT space. So that as it gets reconfigured for these different cooling solutions, we maintain the secure IT environment.

So in a way, I know I haven't described the mechanical system, but the mechanical system, we have a very flexible mechanical system and it's married to a relatively inflexible electrical system. And we bridge that with a relatively semi-architectural system in order to [00:26:00] provide a total design that meets the use of the client taking into account the requirement that it's installed.

Paul T.: That's interesting. So Ken, I've heard a lot today. I mean, there's a lot going on with this cloud condo strategy and it's pretty fascinating. It seems to be, it offers a lot of flexibility, and scalability, and... So I'm kind of curious, can you summarize for us the advantages [00:26:30] of the cloud condo strategy?

Kenneth Kutsmed...: I think, like you said, as Dave and Paul, have discussed the isolation, the security, the flexibility are advantages over that traditional colo. But I think the major advantage is the speed to online availability. I mean the cloud condo plug and play block concept really shortens the design period. We have the base design components developed and then we can quickly adapt those depending on the various clients, depending on the region or even the site [00:27:00] configuration, how it's laid out. And because Jacobs is an integrated firm, each of our disciplines can perform those adaptations in parallel with each other. So we're doing it much quicker. You also look at the construction side, it's also shorter. The modular construction, the prefabrication, skid mounted, even vendor autonomy, and active supply chains can help reduce that construction of time. I mean, the thing is Jacobs really analyzed their experience with the traditional colocation and the hyper-scale to develop [00:27:30] this cloud condo design. And it's a concept that meets the needs and the variety of the different hyper-scale clients that are out there. And it does it in the modularity and the speed of the colocation.

Paul T.: Okay. So I guess the last question for today is, what are the next steps for a client or potential client who wants to get started or wants to learn more about cloud condos?

Kenneth Kutsmed...: Yes, so as part of this concept development Jacobs developed what we call a programming tool. And it allows [00:28:00] us to kind of review and evaluate customer criteria. So the tool really helps us customize our approach and it starts adaptation period of the cloud condo design for that individual client. So I think the next step would really be to reach out to Jacobs, learn more about the cloud condo design. We can give you the visuals that go along with it. And then

we can start inputting that data into the Jacobs programming tool to move us forward and to understand what they're looking for.

Paul T.: Excellent. Well, Ken, Dave, [00:28:30] and Paul, I want to thank all of you for your time today, and walking me through the cloud condo. I do think it's really fascinating. It seems it's a great mix of that scalability and flexibility of design. And it kind of a new way of looking at data center needs. Particularly as we see an acceleration in data and data usage across the globe. So thank you to the three of you for your time today.

Kenneth Kutsmed...: Thank you.

Paul D'Onofrio: [00:29:00] Thank you. Thanks for having us.

David Seger: Thank you.