Constellations Podcast

Episode 178 – Software, Satellites and a More Dynamic World

Speakers: Nathan de Ruiter, Managing Director, Euroconsult Canada, Amina Boubendir, Head of Research and Standardization, Airbus Defence and Space, and Stuart Daughtridge, VP of Advanced Technology, Kratos – 30 minutes

John Gilroy: Welcome. My name is John Gilroy, and I will be your moderator today. And I'd just like to welcome everyone to this recording of the Constellations Podcast. We're happy to be recording this on the show floor of Satellite. Trying to get a feel for the audience here, so raise your hand if you know who Marc Andreessen is. How many people know who Marc Andreessen is? Really? Wow, this is not very technical oriented. In 1993, Marc Andreessen co-founded a little company called Netscape and they develop a graphical browser called the Navigator.

In 1993, that was a big deal. In 2011, he wrote a small little blog post and he said that software is eating the world. And so he said some pretty powerful things over the years. I think he was referring to how more and more industries are being run on software. The satellite industry has not been swallowed by software yet, but more and more bites are being taken every day. As space becomes increasingly dynamic, the industry is turning to software to move faster, to become automated and agile.

This is evident in how satellites and ground systems are being much more software-defined, integrated, and orchestrated to enable new and more flexible business models. On Constellations today, we have with us an outstanding panel of experts that will discuss the softwarization, is that a word? I guess it's a word. It's a new word, softwarization of satellites and ground systems and the increasing integration between the two. Joining us today, we have Nathan De Ruiter, the Managing Director of Euroconsult Canada.

We have Amina Boubendir, Head of Research and Standardization at Airbus Defence and Space. And if I'm not blocking him, we have Stuart Daughtridge, who is Vice President of Advanced Technology for Kratos. So I got about 10 questions. We got about 30 minutes. I'm going to hit them hard. And if they have any energy left, maybe they answer some of your questions. So my first question right here, I think I'm going to pick on Stuart to begin with. I'm going to start with you Stuart.

John Gilroy: So everyone walking around the show, we talk to people, you hear a lot about software-defined systems and software-defined ground. So Stuart, what does it mean for the satellite and ground system to be software-defined?

KRATOS

Stuart Daughtridge: So for the satellite, a software-defined satellite basically means that you typically have a phased array antenna and you have a channelizer behind it. And what that allows you to do is control and place beams where you want them to be, control how much power goes into each beam and how much bandwidth goes into each beam. And that way you can move capacity and bandwidth where you need it and when you need it.

On the ground side, software-defined ground typically means where you digitize as close to the antenna as possible and then you virtualize using software-defined network functions the rest of the ground system. So all your signal routing and all your signal processing becomes software applications running on generic compute and begin to look like a typical IT network infrastructure.

And why that's great is because software-defined satellites tend to have significantly more bandwidth than traditional satellites, and you need to be able to have a ground system that can scale to match up with the software-defined satellite.

John Gilroy: Amina, you want to contribute here?

Amina Boubendir: Yeah, sure. So if we take software-defined networks in general, it's the abstraction that we bring in a system to separate the software and the hardware. And when you break up this association of software and hardware, then you can introduce APIs, so programmable interfaces where you can program your network and you can update your software without being tightly linked to your hardware. We cannot talk about software-defined networks without talking about network virtualization, which is in general also separating the hardware from the software, but making sure the compute is there available whenever we need to scale up or down. So using the computing, the networking resources as we need them, again, thanks to this abstraction from the hardware.

John Gilroy: Nathan, I got the next question for you. Want to jump in with this first one about abstraction and software-defined networks? Any comments?

Nathan De Ruiter: No, I think it's perfectly well explained.

John Gilroy: Good. Yeah, I think abstraction really is the key to understanding it. It's a good word to use there. So Nathan, software-defined satellites offer increased flexibility and enable new business models. So what applications are the best fit for these satellites?

Nathan De Ruiter: So first of all, it can support all applications. That's important to keep in mind. Where we see the best fit is basically primarily the applications where demand can really evolve or the demand patterns can really change. So think about a

MilSatCom where typically a conflict can arise, geopolitical situation can change. So demand can certainly for bandwidth and communication can spike up in new conflict areas, right? So that's clearly one market where we see a big fit.

Another market, the mobility market, so again, traffic moving along. Think about an operator, for example, that once they launch a satellite, they're able to secure a big airline customer. When you have an airline customer, they have a lot of planes operating in a specific area. So you can modify the coverage and bring really the capacity to that coverage area where you need it. So that's really the flexibility as you pointed to for these use cases where demand is not always known, especially when you look in GEO 15-years- business plans. It's a very long period. Demand change. So giving that flexibility to be able to change it and bring really capacity where it's needed, that's the biggest advantage.

John Gilroy: So Amina, apps for software-defined satellites, which ones do you like? Which things fit best?

Amina Boubendir: Can be anything?

John Gilroy: Anything.

Amina Boubendir: So the application and the type of the satellite, so it can be commercial satcom, military satcom, governmental satcom, earth observation, all satellite systems do have ground systems and those ground systems being virtualized can still support the satellite missions. So it's absolutely any application that is already imagined or nuanced. Because as you mentioned, we introduce a flexibility in supporting new applications. So because of the software that is, again, abstracted from the hardware,

Then we can imagine the application layer evolving while the hardware also is making its way into new technologies, for example, being integrated with other technologies and being either also automated so we can automate the network to support new applications. And the flexibility that a provider will have is to offer different services because we can rely on a service-based way of offering the service. So the way the consumer will also consume the satcomcapability will be relying on the dynamicity that the softwarization would bring to the hardware. So again, any application.

John Gilroy: So Stuart, when I was a young man, I was taught never use the word all because you're in big trouble. I mean, you just said all. Do you think it's all applications really? Is there any kind of guidelines here?

Stuart Daughtridge: Well, I think there's definitely going to be applications where software-defined ground is not going to be the right answer. Take something like there's going to be application where SWaP is so important that an ASIC is just going to be the

best answer and you're going to go with an ASIC solution because it's a single use application and size, weight, and power matter for everything.

But if you want a terminal that has multifunction capability that can support dynamic services, then that's where you're going to start looking at software-defined ground systems, particularly at the remote side. The gateway side, software-defined ground just makes sense because your gateway becomes a cloud or you just have a connection to a cloud for your signal processing.

John Gilroy: Gateway becomes a cloud, that's virtualization, isn't it? So Nathan, with socks like that, I got to ask the next question. These are really classic socks. So Nathan, how are satellite operators that have deployed these software-defined satellites using them today or planning to use them to enhance their businesses?

Nathan De Ruiter: Yeah, this is a good question. Actually I will give you a world exclusive. We just are launching a report today where we actually focus on the software-defined satellites and have some in-depth analysis around it. And one of the key results we also see, if you look at the satellite orders from 2019, more than 50% of those GEO andHTSsatellites, communication satellites are what we call fully software-defined. So that's a clear shift in where we see. It shows that satellite operators in the market are gearing towards that solution.

Actually 2023 was 60%. So there's really clear upward strength. So the other distinction we need to make I think today, of course, there is satellite software capabilities in the market, but we still have to see the real impact. The fully flexible software-defined satellites needs to be launched. There's still a lot of progress that have to be done on the ground to really see the full benefit.

But if you could take why the operators are investing in that today, it's really primarily the functionality of, of course, around the world is becoming more software-defined, but also giving you the increased flexibility of, I discussed before, being able to change. It's very difficult to predict the next 10, 20 years how things look in the future. So being able to adapt your capabilities to what the customer wants is a key one. The other one is the operators look at fill rate. How do you utilize the system?

And I think it gives you the flexibility to optimize those fill rates over a longer term. So that's the biggest plus. There's also a caveat. I think when we look at where we are today and where we things started, especially on the software satellite side, the prices were very attractive. These have been moving a little bit upwards. Timelines has started to move a little bit. So I think it's also something that there is a strong value in software-defined solutions, but it requires investment on the satellite, on the ground.

And it's important to keep elements I think in line because the market is becoming very competitive. Starlink putting the new elements of the market that doesn't really allow for a lot of premiums in there. I think there is great, I think bright side for this market segment and for software-defined satellites, but the price points also. And I think with the engineering completed, they will come down, but they have to come down or are being competitive over the longer term.

John Gilroy: Amina, business applications for software-defined satellites, you walk around the show floor here at Satellite, all kinds... In fact, new companies I see today. And you go upstairs, there's all kinds of companies up there. So what do you think about business applications for software-defined? What's your perspective?

Amina Boubendir: For satellite network operators, it's definitely a different way they can rethink their business models because instead of dedicating the capacity to a certain client, they can still reuse the same assets and share it as needed between different clients. It's not the traditional way of selling raw capacity and keeping it dedicated, but also to look at the assets as reprogrammable so they can think of new services to add them. So it's not just about the coverage and the capacity, but also about full service.

So we can talk about managed services. I think this is a word that is quite known for services. The quality of service is really important for the client. So we need to manage those services and not just give the coverage needed in that specific area. It goes hand in hand with the programmability enablers, but also with everything as a service. So everything that is customizable in the whole system can be offered through catalogs or directly knowing my existing client and updating the SLA that I already have with them.

John Gilroy: So I mean, I have a question about data centers and satellites. If you go 10, 15 miles from here, you go to Ashburn, Virginia, throw a stone, you hit a data center every five minutes. They can refresh automatically remotely. Let's apply this to maybe satellites. So how are ground systems evolving to keep pace with new satellites that can refresh and reconfigure themselves on demand just like terrestrial networks?

Amina Boubendir: The ecosystem is being split and the hyperscalers are now clearly in the value chain. So the work, for example, within DIFI, IEEE DIFI Consortium, we're working on making the antenna, so on the ground, the ground system, the simplest possible so that all the processes, all the network functions can go into generic purpose hardware and that's where the cloud comes into play.

This generic purpose hardware does offer this flexibility, but also dynamicity in terms of system to scale up and down, add specific features for the system,

probably security aspects, AI automation to manage the resources on the ground and also allow for linking to different providers. I can rely on different providers for the sensor light on different providers on the ground. And this is also something that is enabled by the software definition, the movement to software-defined networks and virtualization.

John Gilroy: Well, Stuart knows a little bit about the ground, so I got to ask him a ground question here. Traditionally, the ground has been an afterthought compared to satellite. So does software-defined ground offer the potential to become a competitive advantage for operators as well?

Stuart Daughtridge: Yeah, absolutely. So one of the things about moving to a software-defined satellite that are completely reconfigurable is there's less differentiation on the satellite between different satellite operators because each satellite is now becoming much more cookie cutter, much more standard. As a result, the difference between satellite operators now become more about orbital slots and about their ground infrastructure and their ground systems.

The other thing with software-defined satellites, with the first ultra-wide band satellites, the ground systems with the legacy architectures actually started costing more than the satellite because they were very hardware centric. And that's a problem for the industry. So that's one of the other things that's going to drive the move to software-defined ground. It gives you a different cost structure to go after building the ground system at scale as is needed for these software-defined satellites.

John Gilroy: So far in the podcast we've talked about software-defined satellites, software-defined working. So Nathan, if they work in tandem, is this a one plus one is three kind of a deal or what can they do that we can't do now?

Nathan De Ruiter: Yeah, no, I mean, I think this is one plus one is three. I think it is unnecessary move to just... I think to adapt to the new environment that we're working towards. I mean, again, I think there might be some efficiency gains as well to be established. Is that like kind of growing the overall market? I don't know. I'm not fully buying into. So the one plus one is three, I'm not there yet, but I do think it's something that the market has...

And if you look at the transition, I think where we are coming from, it's something that is needed for this industry to move forward and remain competitive. So yeah, maybe the others have a one for three calculation they can share, but I'm very interested to see that.

John Gilroy: I opened up talking about Marc Andreessen and he had a vision for the internet. His vision was graphical. And I'm going to ask about Stuart's vision here. So how

does this vision of a software-defined satellite and ground system working together, nice in theory, but how does it become a reality?

Stuart Daughtridge: Well, I think it becomes a reality because it pretty much has to become a reality. If the rest of the industry is going to compete with Starlink, they're going to have to grow the amount of capacity they have per satellite. They're going to have to have a cost-effective ground infrastructure to be able to implement it, and they have to integrate in with the terrestrial network. And so the way I see the future looking is these software-defined satellites are basically going to start to look like network switches or routers in the sky.

And you're going to start managing your network the same way the terrestrial guys do. And so satellite ground systems will start looking like O-RAN. They'll be virtualized and they'll be automated to a certain extent. But the future is we start looking a lot more like a terrestrial network that just happened to have one of the routers or switches in space and we get way more integrated with the terrestrial networks, whether they be the mobile networks or the telecom networks.

John Gilroy: So Amina, does this sound like, to coin a phrase, pie in the sky? Does this sound like some fanciful thing, or do you actually think this is going to to become a reality?

Amina Boubendir: I think with Kratos, we already worked to start making it a reality. So you mentioned management, and that's where we know... Actually the softwarization is also a disaggregation of the networks. You mentioned O-RAN as well. We're disaggregating the network functions in order to make them softwarized, but also then we need to manage this. It does bring also complexity that we need to manage. And when it comes to managing it, we cannot remain with the old systems that were built for vertically integrated solutions.

We need to think multi-domain, multi-technology, multi-provider. When it comes to satellite, multi-orbit, multi-frequency. So when this comes into play, we need a standardized solutions. From the management perspective, we worked with Kratos under the TM Forum standardization body that defines OSS, BSS, and network management systems in terms of digital systems with APIs that are standardized that any partner in industry can implement and reuse. And Kratos did this for the resource level.

We worked with satellite network operators to show that the satellite is just another wireless technology and it can be implemented from the management perspective using standardized APIs. And also the integration with the terrestrial, we're moving ahead. This work has been done last year, and the work we're doing this year is integrating 5G and satcom into a standardized framework, again, from the management perspective and the TM Forum. So this

applies to a process known under TM Forum so that it's offered product, service, and resource.

So it's well-defined and all the APIs are there. They're open and can be modified. And probably I can speak for Kratos to go and see the open space demo that integrates part of them. We're working hand-in-hand and there's probably a call to collaborate into standardization because that's the only way to make sure the systems will be really integral.

John Gilroy: I got a question for Nathan. We've been talking about flying routers and pie in the sky and virtual ground. Is it a real ground? No, it's virtual ground. So what's your prediction? Is this really going to come to fruition? Is this going to come to reality? It seems very complex.

Nathan De Ruiter: Yeah, there's two things to see it. I do want to echo the point that Amina made about standardization. I think it's a very central part of this. From any perspective, I think the pace of adoption of this, you would probably want to say, I mean, there's a lot of good work done, but you would like to see it accelerated. But obviously there is investments required on the ground, on the satellite. There's a system resource management software that all needs to work all together.

And I think that it's just very difficult from the operator or other players into the market when you invest in something and it's not compatible with others. It's such an inefficiency. I think that would hamper larger market adoption. So I think the pace of adoption is really going to be driven by how quick we're going to push the standardization into this industry, which I think the debates are there. And I think the open discussion, the willingness is there, but really to push that forward is I think the next cornerstone to make this a reality.

John Gilroy: Well, standardization is a topic in the software world, satellite world as well. So Stuart, I don't know if standardization is going to solve all these problems. Because if you look at the satellite industry, players have often operated in silos, in siloed fashion in terms of space and ground segment. So how can satellite manufacturers on one hand and ground system providers on the other, how can they closely work together and integrate systems to unlock this full value of a completely software-defined system? So standardization, how do you get them out of the silos?

Stuart Daughtridge: I think there's a couple different ways, but the one Amina just mentioned the work we did with Airbus and there are several satellite operators involved working to develop a standardized way to manage satcom networks using telecom standards. We worked with the TM Forum and implemented a version of the MEF standards to basically automate the orchestration of services. They

were using their off-the-shelf APIs and we proved that you could do it. And that was last year.

This year we're going to the next level more around the orchestration of services at the higher levels, showing how you could use telecom orchestrators to actually orchestrate services directly through a satcom service. And in that case, we had satellite operators, satellite manufacturers and satellite vendors all working together to show how we could use these standards. The reason you use standards is to get scale. Because the more you can do it, you get standards and you get everyone doing it the same way, you now can get scale and size and parts and things like that.

So I think that's all a key part of it. The other thing is is with software-defined satellites, to derive the full value out of that software-defined satellite, your ground has to integrate with it and coordinate with it. It's going to happen because it has to happen. Otherwise, the satellite operators won't get the value out of their satellites. And so industry just will do it.

John Gilroy: I mean, I've known Stuart for a while and I have him classified as kind of a ground guy, yet he just said off-the-shelf API. He sounded like he's a software guy. He's making the transition right before our very eyes. So what about this transition? You think it's possible? You think there's going to be standards or have to work more closely together than that?

Amina Boubendir: Yeah, definitely. I come from a telco background and it seems obvious when you operate now it's on the ground to have this interoperability. It's not just from a provider perspective, but also from user perspective. When it comes to mobility, this is the simplest example, because with your devices, your room... I traveled from France to the US and my mobile is still working.

Well, that's thanks to the interoperability and thanks to the standards that the telcos have developed since 2G. So same should apply to the satcom. The devices, the terminals should be able to have seamless mobility between satcom solutions, and that's another step between mobile and satcom, and that's the integration that we have with the terrestrial and non-terrestrial networks.

And this is happening today in 3GPP. Airbus is involved. We're working on it. So 5G NTN, that's part of 5G advanced specifications. And we're also putting this under a new umbrella. Maybe that may seem as a buzzword, but it's not. We're thinking 6G as the mother next generation to integrate terrestrial and non-terrestrial technologies.

John Gilroy: Nathan and I have a four-year-old grandson and my goal is for him to play with others nicely. That's very nice. At that age, you play with each other nicely and

share things. What about these silos, satellite manufacturers, assistant providers? Are they going to act like four-year olds, or are they going to learn how to play together nicely?

Nathan De Ruiter: No, yeah, I do want to make a compliment. I think there is a willingness, I think, to more closely work together. It's also necessitated by the environment where it is. But I think of course, the satellite industry has been criticized by the silos for many, many years, but I do see the change in that. And then of course, they need to prove themselves that it's all going to work together. But I do think that there is a meaningful mindset change in working and working together. Even this podcast is proof of that.

John Gilroy: So Amina, in America here, we have this thing called football and they have a two-minute drill. We're going to give you a one-minute drill. We want to drill here and I want you to cast your gaze into the future and tell us where you see this whole idea of software as a service, grounds as a service, different companies working with each other, how do you think it's going to play out in the next five years?

Amina Boubendir: I think if we think of the integration that is almost happening naturally, we think of the simplicity that should be brought to the users. If we stick to software is eating the world, that's definitely happening. We have witnessed different convergences, so fixed mobile and then IT cloud, IT and networks and our satellites and networks, and all this is driven by software. So if this wave of software is still there, then it will be really applied to all the stack.

If we think of a network as a network of networks, then what does that mean when it comes to my experience as a user, as a consumer also? When I go to purchase a product, is that simple? We hear a lot about marketplaces, how we can think of optimizing the resources, optimizing the assets that are there, reusing, maybe reuse as a keyword when it comes to software networks. And again, this cannot be possible if standards are not well-developed.

John Gilroy: It's been a real great conversation. I'm sure that Marc Andreessen will be proud of all these software technicians up here. Give them a round of applause. Thank you very much.