Constellations Podcast

Episode 175 – Spectrum Sharing, Laser Networks and Open Access

Speakers: Declan Ganley, CEO, and Konrad Nieradka, Vice President of Product Management, Rivada Space Networks – 33 minutes

John Gilroy: Welcome to Constellations, the podcast from Kratos. My name is John Gilroy and I will be your moderator. Today, we'll be talking about the OuterNET and what new capabilities it is bringing to the space ecosystem, as well as standards like MEF, M-E-F. We're glad to have not one, but two guests on the podcast today. Declan Ganley is the CEO of Rivada Networks, and Konrad Nieradka is Vice President of Product Management.

Well, Declan, you're the CEO, so we got to start with you. You've got a lot of experience in this industry. As an early and ongoing entrepreneur, you must have experienced many opportunities to leverage your background in telecommunication networks. What technology or event happened that caused you to pivot towards satellite communication?

Declan Ganley: It was really when the ITU decided to allocate spectrum for low Earth orbit satellite constellations and to do so in a way that made it clear that spectrum sharing was going to be pretty central to their plans. And also, I had been tracking the advancement of optics and laser links and how optical laser links would be playing such a key role in future telecommunications networks. And the idea of putting an optical link into low Earth orbit space, which is a near vacuum, it was obvious that the physics of that were going to allow for much faster and much more secure communications networks. And it was a culmination of the ITU making the shared spectrum available in the Ka band, the technology around optical links without using fiber. Because if you eliminate the fiber and you just have a pure light laser link, then the speed of that link is faster than light through fiber, considerably faster than light through fiber.

And the idea of eliminating what I always knew with the bottlenecks in satellite systems, which was the ground relay station, because you went up to the satellite, the satellite landed you back in a ground relay station, and that became a sort of a bent pipe or a dog's leg of the communication signal, once you could put routers, as the Americans call them, or routers as we call them over here, into space, you could really speed the whole process up, make the track much faster. And it was really a combination of all of those things that made me start to look hard. And the fact that it had been, and it was being very well covered, that launch costs were coming down. And so that created what I would sort of call a Goldilocks mixture of factors, that when you added them all up, made something that was just right to move into this area.

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John Gilroy: Declan, sounds like a perfect storm. The ITU optical innovation and launch has become inexpensive. If you talk to a physicist about some of the limitations in light communications, they talk about, appropriately, Shannon's Law. You're in Ireland now, and so the Shannon Law, you max out, but there's no max out when you're in outer space, is there? It's a perfect straight connection, you get lots of speed.

Declan Ganley: That's right. That's right. And so you both have the speed advantage, using the near vacuum of space for a light link. We don't have thousands and thousands of satellites in our constellation design. We deliberately went for slightly higher orbits. They're still low Earth orbits, but they're at 1050 kilometers. And in my terrestrial wireless head, I think about this as having the hilltop sites rather than down in the valley sites. And it's better to have the hilltop sites. And then each one of those satellites has got four lasers on it linking to satellites in an adjacent plane. And we also have polar orbits at 89 degree inclination, which means that the roots that we can take through that satellite mesh, think of it a bit like a fishing net cast around the whole planet. We can go polar, we can go any which way we need to. So, we have the fastest routing options and we have multiple routing options for every piece of traffic that we have.

And the attack surface on the network, because we don't use ground relay, is much, much smaller than it is on any other network, including LEO Networks, low Earth orbit networks, because all the others do use ground relay, we do not. And the architecture of this system has been to create the OuterNET, something distinct and separate from the internet, that is truly global, that can cover any square meter of the surface of the planet, that does not have to touch the internet unless it wants to. And so, the OuterNET is not just some marketing term, it's a real thing. And this will be the world's first truly global, truly separate network, entirely separated from the internet. So, we're excited about this.

John Gilroy: Declan, there's an interview of you on YouTube and you talk about prioritization. And it may be hard for some people to understand this concept. What do you mean by prioritization of spectrum assets for commercial use? Is that like quality of service or what exactly does that mean?

Declan Ganley: This was really smart on the part of the IT. I've been talking about priority access and what we were calling even ruthless preemption in the public safety terms, that we should be allocating radio spectrum in a way that ensures its best and highest use. And the ITU figured this out. And what priority means in the context of the Ka band, for example, which is the band I know most well, given that that's the license that we have, this is not a perfect comparison, but it's the best way I've come up with trying to sort of encapsulating it so far. Which is, it's a bit like the spectrum is shared and it's shared between anybody that's licensed in the Ka band, but it's shared on the base of priority. And if you are first to file, a little bit like a patent, you've got the top priority use as long as you do your build out and everything else, you won't lose it. It's like having boarding group one on an airplane.

Now, if you are on boarding group one and there's only 12 people on the plane and the plane's got 200 seats on it, then it doesn't really matter. You're going to get on your seat anyway. But if you are boarding group one and the plane is packed, full, then it's good to be in boarding group one. The difference here with the way that this priority works is that boarding group one basically gets to take as many seats as it needs and then boarding group two can start and so on and so forth. So, the priority is important. You will find others that will tell you, "Oh, it's not that important." They tend to be the folks that don't have it.

And what it doesn't allow you to do, and it's important to stress this, is you can't be a bad neighbor. So, you can't be a trouble. Just because you've got boarding group one, doesn't mean you can punch boarding group two in the face. You have to be polite, you have to be courteous, you have to allow for other users to also be able to use that shared spectrum. But the way the coordination obligations work, it is better to have, the higher the priority you have, the better you are positioned when it comes to coordination with other users.

John Gilroy: Declan, I guess from your perspective, there are opportunities to share a Ka band in LEO, is that right?

Declan Ganley: Well, there is, I mean for the description I just gave, the way the ITU has allocated the Ka band, it has intentionally allowed for a spectrum sharing regime. It so happens that we have the top priority to the Ka band, because that's how it's worked out with the dates and submissions of the filings and the compliance with the regulations that cover them. But yes, it is a shared spectrum regime and Rivada has the top priority to the Ka band. That does not mean others cannot use it, they can. And we will be coordinating with them on the use of the Ka band. There's lots of it, which is great. And of course it covers the whole planet. But yes, it's a shared band and that's the regime that it's been set up under and I think it's a really smart way of doing it.

John Gilroy: Well, let's maybe dig a little bit deeper into this OuterNET concept here. How would someone envision that? Is that bi-directional, one directional, or how does that all work?

Declan Ganley: The OuterNET concept is about putting routers in space, linking them optically and having a system where you go up from your ground terminal in the Ka band of the radio frequency to the satellite constellation, and then instead of the satellite constellation landing you back into a ground relay station and then putting you across the same subsea cables and internet that everybody else uses, instead of doing that, the signal stays on the constellation on the laser network and is relayed across the laser network, the mesh, to its final and end destination and without having to touch the internet and without using ground relay stations.

John Gilroy: Declan, what is a global OuterNET? I hear the term a lot. How should we envision that?

Declan Ganley: The global OuterNET is, well, first of all, it's global. Meaning it covers the whole planet, not just a few places. And to do that with a low Earth orbit satellite constellation, you have to have polar orbits because that is the only way that you can cover all of the planet, including the poles and the high north and low south. Most, in fact, for folks let's say that have flown from Tokyo to London, when you fly over the North Pole, you'll notice that your wifi doesn't work for about six hours of that flight. Well, that's because you exit from satellite coverage because most of the geostationary satellites are parked over the equator and they can only see up to a particular latitude before you lose coverage.

In our case, we use polar orbits at 89 degrees inclination, which means that you have got a number of satellites, because we have 24 orbital planes, you have a number of satellites that are visible from any square meter of the surface of the planet. So if you can see the sky, you can see some of our satellites because they're also at 1050 kilometers of altitude and in polar orbits. So, that means they can see all of the surface of the planet.

The other thing that the OuterNET means is that, and I think for it to qualify as OuterNET, it's a communications network and system that does not have to touch the internet. Meaning, you go up from your ground terminal to the OuterNET, to one of our satellites, your signal is relayed over one of the four laser connectors on that satellite to an adjacent satellite and is taken around the planets in the most efficient path possible and then landed in the Ka band at its end destination. We do not use ground relay stations. Every other satellite constellation that you've heard of, whether it's a geostationary or whether it's even a low Earth orbit satellite, they all use ground relay stations. So, they're kind of a big last mile solution.

So, you go up to the satellite, the satellite is looking to land you to the closest ground relay station, it does so and then you're on the same subsea cables and networks as everybody else. What Rivada does with the OuterNET is it takes the internet, the subsea cables, all of those things out of the equation, and it instead puts you on its laser mesh network and can send you anywhere around the planet from any point to the other. And because we've got those polar orbits and because they're at 1050 kilometers, we can do that for anywhere on the planet.

John Gilroy: Now, we began the interview, we talked about your long career in telecommunications. Back 20, 25 years ago, people started talking about MPLS long, long time ago, I remember. And I think there's an interview you gave, you wrote that, you said that Rivada will be the first MPLS network in LEO. What does that mean and why is that so significant?

Declan Ganley: Well, it means that it's a network that follows and complies with the same standards as the big telecom networks do on the ground. It means in very, very simple terms, that we can, instead of giving a best efforts contract or a best efforts guarantee, which means we'll try our best to give you this speed, this kind of link security, instead of giving a best efforts contract, we can give a guaranteed throughput. We can agree to standards that are common between the big operators on the ground.

So for example, between AT&T and British Telecom, or AT&T and France Telecom, or Vodafone and Orange. So, these sorts of agreements that comply in the terrestrial environment can now be applied to this particular LEO constellation. And that is because of the way that we architect the system. And you're going to be speaking with Konrad here shortly. Konrad can get more into the weeds with you on this, but that's my very quick summary.

John Gilroy: Let's stick around with MPLS for a little bit here. I think there's more advantages to it too. What about security and network efficiency and interoperability with other service providers? That's what MPLS really provides, is that right?

Declan Ganley: Right, exactly. And it's a higher level of security and interoperability and reliability than we have previously seen in the satellite arena or even, in many cases, in the wireless arena. Again, it's the difference between a best efforts contract and a guaranteed supply contract. And with the layers of security and interoperability that are inherent in the sorts of agreements you see between big operators in the terrestrial environment, if you are an operator, this is a game changer. This is a big differentiator, that you have a satellite constellation that can enter into what's called a service level agreement rather than a best ever agreement. That's significant.

John Gilroy: Well, let's expand this concept of security and talk about cybersecurity. I think cybersecurity of satellite systems has become a big issue in recent years. Can you talk about the threats and any initiatives you're involved in to improve security for satellite assets and networks?

Declan Ganley: I can't talk about all of them, but I can talk about some. First of all, my background, I've spent years in the public safety and security communications area. That's what Rivada Networks, the parent company, when it was set up in 2005, that's what its complete focus was on that area. So, we have had security and cybersecurity in our DNA before people were even talking about cybersecurity, before it was a thing. And it was one of the things that I found so attractive about this opportunity with Rivada Space Networks, was the OuterNET, the design of this system, the architecture of this system was such that it allowed for a global communications network to be deployed and put into operation that had a tiny attack surface compared to any other satellite constellation or, indeed, any other network that touches the internet.

Because we can keep all of that traffic, not on a virtual private network, but on an actual private network, a real physical private network, this one deployed in space, that meant that you could give levels of cybersecurity before we even begin to layer on top the encryption and everything else. That the physics of this network are so different that it makes the attack surface almost incomparably smaller than is the case with any other communications network. And I found that extremely compelling. So, you've got a real private network that is global, that has a tiny attack surface. It doesn't mean it can't be attacked, but it means that to attack it is, the barriers to entry are infinitesimally higher than they are for other communications networks.

John Gilroy: When people talk about security, talk about encryption and the leading edge of encryption of course is quantum encryption. So my question to you, Declan, is, do you think quantum encryption is a technical capability that can play a role in space cybersecurity and how it all work?

Declan Ganley: Yeah, definitely. Look, quantum encryption will play a role in all communications. One of the things that quantum encryption is going to need, especially when being applied with artificial intelligence, which is the sort of buzz phrase of the year, quantum and AI, when you layer them one on top of the other, the other piece they need to that particular lasagna or mille-feuille is they need ultra-fast, low latency, secure communications networks. Well, it so happens that the OuterNET that we are deploying will have the lowest latency on the planet, over 4,000 kilometers.

So, let me put that into context. A fiber optic cable, if we had a dedicated fiber optic cable that went from where I am in Ireland today to where you are in America today, at 4,000 kilometers distance the speed of the signal from me to you over that dedicated fiber, if it was dedicated, so not going through any other filters, that speed would be the same as if we went over Rivada's OuterNET at 4,000 kilometers at 4,001 kilometers or anything greater than that, the OuterNET's going to be faster. Because of the physics of the network, because it uses light in a vacuum rather than right light through fiber, light in a vacuum goes faster than light through fiber. So, the latency on this global network is going to be lower than anything else that's out there.

Now, why is that relevant to quantum and AI? Because quantum and AI, to be able to implement the advantages of the computing speed that you get with quantum and AI, latency where you, for example, link a quantum computer in, let's say, Japan with a quantum computer in Germany, over those distances ultra low latency is going to be a massive differentiator and it already is a differentiator for things like high frequency trading in the financial markets. Quantum is many, many times faster and more demanding of low latency than even high frequency trading. And so, yes, this is going to be highly applicable.

I would say the OuterNET will become the cardiovascular system or, if you like, the neurological links between quantum computers and for artificial intelligence to work on a global scale, those neural links, those synapses that connect those quantum computers together are going to end up riding on the OuterNET, both for speed and for security reasons. That's a supposition right now. I can't prove that to you right now, but logically, if you think about the physics and how they work, I think that's where that traffic's going to end up.

John Gilroy: Good. I have some questions for Konrad here. Konrad, I'm not going to give you a question involving quantum mechanics and the mathematics behind all that. I'm going to give you some easy questions here. That sound good, Konrad?

Konrad Nieradka: Thank you for being merciful.

John Gilroy: Okay. I understand that Rivada is one of only a handful of satellite companies involved with MEF. We mentioned earlier M-E-F, MEF. And we just had MEF's vice president of strategy on the show. Konrad, what are the benefits of getting involved with MEF and MEF standards like Carrier Ethernet from a satellite service provider's perspective?

Konrad Nieradka: First of all, for the listeners who may have missed your recent webcast, please give it a try. It's really interesting. MEF stands for Metro Ethernet Forum. It's an industrial association responsible for standardization of enterprise or carrier grade connectivity services. And as this is the core market for us, it was natural for us to join the MEF Forum and to work together with our soon to be customers and users on shaping the future of enterprise communications. We will certify our services for compliance with MEF standards. What this means is that the resellers and end users will always know exactly what they are paying for and what kind of behavior to expect from our service. And you're right that the satellite operators are quite new to the Carrier Ethernet ecosystem, but we do see a lot of interest in our capabilities from the incumbent telcos and from customers who are not currently using satellites. So, we believe that we have found a nice niche for ourselves and we are bringing a unique and much needed product to this market.

John Gilroy: Good. Let's maybe apply M-E-F, or MEF, to your company. So, are MEF standards or MEF APIs important for this OuterNET ecosystem? And are these types of standards that'll help other companies to interact with Rivada?

Konrad Nieradka: Yes, indeed. You're throwing a lot of acronyms at me. So APIs are the Application Programming Interfaces and they have two roles. One is for the ease of build. So, when you are building a new telco solution, you can build the whole thing from elements of different vendors and they will nicely fit together like Lego bricks, they will be like plug-and-play features that you can combine together with ease. The second role, that is more important to us, deals with the ease of doing business. It enables a plug-and-play experience when integrating operators, service providers, and end user systems. These APIs translate any internal language of their systems to a common format, allowing easy and fast integration of even the most complex solutions involving multiple operators on different continents. So, this will allow us doing easy business with both big telcos, multinational carriers, as well as small national providers for the enterprise market.

And why is this all important? The OuterNET, the certification, the APIs? Our overarching goal is to deliver the user a connectivity service that has the committed bandwidth and quality of service of a terrestrial private network, the global reach and mobility capabilities of a satellite system, and the agility and ease of use of a cloud solution. We are trying to combine the best of all the worlds.

John Gilroy: Well, Konrad, in the last five minutes we went from quantum mechanics to Legos. So, we have a range of topics we're covering here, huh? Okay, let's get serious. How are MEF-certified Carrier Ethernet carriers acting or interacting with this OuterNET? And why is that different than other networks?

Konrad Nieradka: Good question. Let's take a large international carrier. None of them have truly global footprint, truly global infrastructure. They are reaching at most three continents. And to connect users on the other ones, they must cooperate with other national carriers or regional operators. MEF standardized Carrier Ethernet allows them to build chains of services that, from the perspective of the end user, form a cohesive end-to-end service. The users and the service providers can search in a common catalog for the services available under their home address. And funny enough, the alternate will be the only such a service to always pop up on their screen, because we will be available everywhere.

And the incumbent carriers will use the alternate to do basically three things: on demand extend the reach of their terrestrial networks into new territories without expensive capital expenditure and multi-year prolonged deployment efforts. Secondly, extend their fixed carry offering, for the first time, to mobile users on planes, on ships, at some point even in space. But let's leave that for another occasion. And finally, offer the most secure end-to-end connectivity to cybersecurity sensitive users like finance, governments, knowledge-based industries, big pharma critical infrastructure, allowing them full sovereignty over the data and independence from any other networks, including the internet and undersea cables. Which we have seen in the past years, are subject to both attacks and disasters that interrupt communications. For many users, this is not acceptable and that's where we come in with much more resilient solution.

John Gilroy: Now, years ago when I first started reading about mesh frameworks, I had this image of a piece of cloth or a mesh or some kind of a framework, and then people started talking about software-defined networks. And now what you're doing with this mesh framework, because you're taking it and putting it outer space. From what I understand, you're setting up a mesh framework in the OuterNET that can quickly transport data to anywhere on the globe. It really is taking the data center and exploding it out to outer space. So, rather than being downlinked to the ground and traveling across the terrestrial network, it could slow it down. So, what about the ground here? How does this data get to the ground? Is it optical? Is it radio frequency, RF? And sometimes optical has challenges with these things called clouds and weather. Is there a solution here, Konrad?

Konrad Nieradka: I like this question. Optical is really good because it has capacity much higher than anything that can be done over radio and it's for free. It's not regulated. We don't have to go to the ITU or to the national regulator to ask for a license for an optical link. So, that's a very good opportunity. But as you have noticed, the clouds come in the way quite often. So for our system, the main access method is Ka band radio frequency. So, it's basically around 17 to 20 gigahertz going down and 27 to 30 gigahertz going up.

That said, we are already using lasers as our mesh network in the sky between the satellites. Who knows, maybe in the next generation we will have additional laser terminals flying on our satellites that will allow us to touch the links with much higher capacity to the ground, of course, in the regions that allow for this weather wise. But this is also something that many companies look at as a future of satellite communications going into higher frequencies and, finally, as high as optical.

John Gilroy: Konrad, earlier you mentioned APIs and software developers love to talk about APIs and they can bore you to tears with all kinds of story about that. They also talk about open source software, but my question's not about open source, it's about open access. So, can you explain to our audience what is meant by open access technology?

Konrad Nieradka: Oh, I would hate to steal this topic from Declan. He's a big open access person, I think he might want to take it.

John Gilroy: Take it quick, get it before he speaks.

Declan Ganley: What's meant by open access technology. Well, the concept of open access is, and it's to lower the barriers of entry to be able to get capacity in a way that we haven't previously seen. Now, inherently it means interoperability as well, but it means allowing a market to find the true value of capacity in any given time and place and to clear it at whatever price the market is willing to pay. And this is a technology and an approach that Rivada pioneered a good number of years ago, and that this shared spectrum environment really lends itself to enabling.

Now, the closest thing that I could point to where we see this happening now in terms of the economics of open access is the electricity market. So, if you were to look at the electricity markets and the way wholesale electricity markets work, they clear all of the capacity, all of the time, whatever the price is paid. Now, that doesn't mean that you can't have premium products, that you can't have products that users will be willing to pay premium prices for, because you will. Because, of course, open access also means that where there is premium value that can be applied, it can be applied. But open access is ultimately about, on average, lowering the barriers to entry, including price, to be able to get gigabits on any network, be it terrestrial or space. That's what we mean when we say open access.

John Gilroy: Wow, that's a good differentiation. That makes sense. Well, Declan and Konrad, I think what you've given our listeners is a better appreciation of this whole concept of the OuterNET and some of the power that it can bring to people just all over the world. I'd like to thank our guests, Declan Ganley, CEO of Rivada Networks, and Konrad Nieradka, Vice President of Product Development. Thank you, gentlemen.

Declan Ganley: Thank you. Pleasure.

Konrad Nieradka: Thanks for having us.