Juniper Networks:
A three-layer approach for a transition to an open NFV environment

A conversation with Steve Shaw,
Product Marketing Director, Juniper Networks

By Monica Paolini
Senza Fili

Juniper Networks in the NFV ecosystem

Juniper Networks is a traditional networking vendor that is embracing NFV. The company is creating an open NFV platform and ecosystem of partners to give customers the freedom to choose best-of-breed elements to ensure an intelligent, highly available NFV solution.

Juniper has a three-layer product strategy to enable the transition to NFV in mobile networks. It includes MetaFabric, its data center architecture at the infrastructure layer; the Contrail Cloud SDN/NFV platform at the control layer; and specific functions such as Firefly Perimeter at the VNF layer. Juniper looks to partner with OSS/BSS companies and third-party VNF suppliers to deliver complete solutions to market.

At the network edge, the Service Control Gateway, based on the MX-3D router, has integrated L4–L7 DPI/TDF and Gx/Gy policy interfaces to PCRF and OCS systems and acts as an intelligent entry point for mobile traffic into the Gi-LAN service core environment. The SCG uses the Junos operating system and can operate within the MetaFabric data center architecture, designed to optimize the allocation of network resources across multiple data centers.

Contrail Networking is an SDN/NFV controller that is integrated with OpenStack and delivers the following capabilities:

- Programmatic provisioning of network resources
- Federation of public, private and hybrid clouds
- Automated service chaining, across both virtual and physical network elements, with service instantiation and monitoring and load balancing
- Real-time and historical analytics to get visibility into traffic flows, and to identify and address issues as they emerge, providing access to application usage, network utilization, and KPIs

The Contrail Cloud NFV Platform complies with the ETSI NFV requirements, supports third-party hypervisors and orchestrators (e.g., CloudStack, OpenStack), and interoperates with OSS/BSS. Juniper has also developed an open source distribution, OpenContrail, with Contrail Networking preconfigured.

At the same time, Juniper has developed partnerships with other vendors in the NFV ecosystem, such as IBM (orchestrator), Nokia (Liquid Core virtual applications) and Amdocs (OSS/BSS).

The Contrail Networking Controller has three components:

- **Configuration management**, to take requests from an orchestrator to provision VMs

- **Control,** to coordinate VM provisioning with network elements
- **Analytics,** to collect, store and analyze information across virtualized and physical network elements

At the VNF layer, Juniper has solutions for virtualized functions that will coexist in multivendor environments in which virtualized services share VMs. The first function to become available is Firefly Perimeter, a security solution in a VM form factor that combines firewall, NAT and routing and VPN capabilities. In addition, Juniper has tested more than 20 third-party VNFs for compatibility with a Contrail Cloud NFV solution.

In a virtualized network in which functions are no longer linked to equipment elements, a new approach to security is called for to shift policy enforcement and firewall protection at the VM

Juniper's Contrail Cloud NFV platform
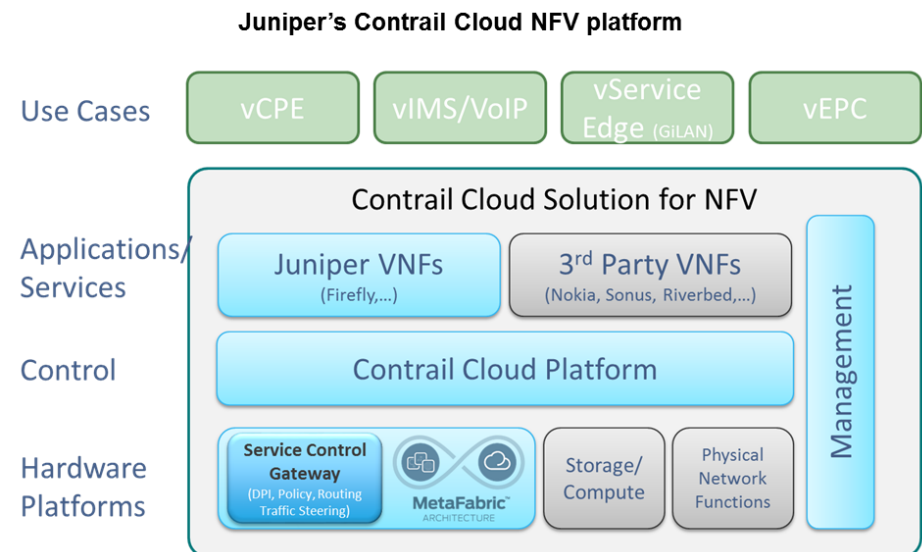
Source: Juniper

level. Firefly Perimeter was designed to meet this goal, while providing the flexibility and agility needed to operate in dynamic environments and provide the performance and visibility that operators require.

A three-layer approach for a transition to an open NFV environment

A conversation with Steve Shaw, Product Marketing Director, Juniper Networks

Monica Paolini. As part of our conversations for our report on the emerging NFV ecosystem, we are talking with Steve Shaw, Product Marketing Director at Juniper.

Steve, to get started, can you give us a brief introduction to Juniper's approach to NFV?

Steve Shaw. Juniper offers an open NFV platform. We think it's going to take more than one vendor to bring together this entire ecosystem. We are building an NFV platform with open building blocks, taking advantage of technologies like OpenStack and open source environments, and really set a foundation for service providers to take

advantage of the power, the agility and the value creation that's going to come from NFV. It's the early days in NFV, too early to get locked into an approach, and this gives our customers the freedom of choice.

Monica. What are these open building blocks?

Steve. Juniper has three layers to its NFV platform. Of course, Juniper's a hardware supplier. We've got MetaFabric, a high-performance line of routing and switching platforms which really help service providers build high-performance, telco-grade data centers for NFV, for the IT infrastructure. That's something that Juniper's been pretty proud of for a couple years now. Plus the Service Control Gateway acts as an intelligent entry point into an NFV environment.

Moving up the food chain a little bit in terms of orchestration and control, Juniper has its Contrail Cloud SDN and NFV platform, which really brings a layer of network virtualization and SDN directly into the data center. It provides a much more powerful and scalable approach to managing virtualized environments and setting up customized service chains. It gives mobile operators the ability to craft exactly how each subscriber uses the network, by sending traffic routed through different services and bringing together all of the automation under an OpenStack umbrella.

And finally at the services layer, Juniper has started virtualizing its own network functions. We do have our own VNFs, the first of which is Firefly, our

virtualized security appliance, which provides firewall and security capabilities built right in.

We also have virtualized other security appliances, including our DDoS prevention. We're really looking to round that out with partners in this space as well, to be able to bring together a full ecosystem for our customers and our service providers.

Monica. MetaFabric is a product that you already have, and it's also available in a virtualized form, right?

Steve. MetaFabric is an extensible data center fabric architecture, so it's designed to start small and grow big, designed for taking advantage of an x86 architecture and providing a very broad switching platform. On the routing side, we have protocols built in to handle connectivity between data centers, different data center architectures that may be using VMware or OpenStack. We're able to bridge those technologies through a routing environment, and lay a foundation for service providers to build their business, and build their data center architectures on top of it.

Monica. Why did you decide to introduce a networking controller like Contrail?

Steve. The initial approach to managing networks inside of a data center architecture wasn't cutting it. Virtual LANs are limited – don't have the scalability, performance and security that service providers look for – and so Juniper acquired Contrail about a year ago.

The Contrail Networking product brings an L3 virtual network overlay to the data center. Rather than looking at things like VLAN application pools, we treat everything as a direct network connection. We bring high-performance and telco-grade routing protocols directly into the data center. We provide IP VPN connectivity, built-in load balancing, and a whole range of analytics that help service providers see what's happening from a networking perspective inside their data center.

Monica. What is it that operators can do differently when they have this virtualized infrastructure?

Steve. The big power that comes from this is service selection and control. Today a service provider of any type – a mobile, cable, or fixed provider – might have a set of applications that they provide to their customers. Maybe it's some kind of traffic shaping, security appliances, some video optimization, but it's very difficult for them to steer traffic, based on subscriber type or based on device type, to different appliances that make sense for what the subscriber's trying to do. They've got one big pipe, and basically, everything runs through it.

With technologies like Contrail Networking and the Service Control Gateway, we're able to really get in and tailor the user experience based on who you are, what device you're using. Contrail Networking is used to automate unique paths through services in the network.

If I'm a Juniper employee, I get routed through the service provider network one way with extra

security and enterprise capabilities added in. If I'm a prepaid MVNO customer, maybe I receive a different tier of security or service path through the network. If I'm watching a video, the network makes sure that I run through a high-performance video compression algorithm.

The ability to do intelligent traffic steering with service chains, across all of these virtualized network environments, is critical for helping service providers differentiate and actually deliver value-add to their customers. That's really where we're seeing the powers of Service Control Gateway with Contrail Networking, and of the Juniper Cloud NFV architecture in general.

Monica. In order to take advantage of traffic steering, an operator needs to have all functions deeply and efficiently integrated. How can they do that?

Steve. Under the heading of our open approach here, everything has RESTful APIs, and the ability to really plug in at any level that one of our partners would like to.

Juniper has teamed up with a couple of companies at the higher order already. About a year ago, as part of our Contrail Networking launch, we announced integration inside of IBM's SmartCloud Orchestrator product, where they're providing the high-level orchestration and service-management components. They have plugged in to our NFV platform.

One of the other companies we've done work with is Nokia. In May of this year, we announced an

agreement to co-create telco-cloud technologies with Nokia that integrate Contrail Networking with Nokia's Liquid Core.

Finally we've done work with Amdocs that we brought out at Mobile World Congress earlier this year. Amdocs provides the higher-level orchestration and OSS/BSS, connecting into our virtualized service orchestration and NFV platform.

Flexibility is a key driver for our customers, and our NFV platform delivers. If they want to do a cloud CPE service, if they want to start to automate their Gi-LAN, or if they want to look at other enterprise-managed services, we're able to now plug in and use the power of the OSS system and the integration with the BSS to drive a complete solution for the service provider.

Monica. With NFV, do you find yourself working more closely with partners?

Steve. Certainly. No single company's going to be able to deliver this whole thing soup to nuts. There are a lot of moving parts, a lot of different technologies.

The power of NFV – and the power of virtualization – is the ability to quickly bring on third-party applications and third-party virtual services, and orchestrate them in and automate them in. This helps the service provider to run through new capabilities and new features, and grow existing capabilities, more quickly. We tested with more than 20 different VNF companies to bring a range of applications onto the platform.

The key word we've all heard is "agile." How can I be more agile in how I build my network? How can I scale my network? How do I automate my network?

Monica. Does it also mean that mobile operators will have more vendors? Their relationship with their vendors is going to be different.

Steve. There's still going to be somebody to orchestrate, manage and deliver the entire solution. But the service providers that are going to win are the ones that are going to embrace this open approach, to embrace other companies, to be able to collaborate, and to build up an ecosystem of network services.

Today there's a handful of companies that provide X service or Y service or Z service. I don't think we're ever going to get to a place like an iTunes store, where there are tens of millions of apps.

But if we can move from a world where there are ten-ish network apps to hundreds of apps, the door really opens for companies to get creative about the services they can develop for the network. If we can start to provide that innovation pipeline for the service providers, and we make it easy with the NFV platform, there is a renaissance opportunity for the service providers.

Monica. Let's move back to the applications. Why did you select security?

Steve. Security is so critical. Time after time and survey after survey, one of the big barriers to adopting cloud – for service providers and

enterprises alike – is the concern about security: the potential threat of managing the experience for their customers and for their data.

Juniper provides a very solid set of security appliances today. We've got a great firewall for data center architectures. By virtualizing our security applications, we're able to help service providers to insert security exactly where they want it. If you want to wrap your DNS server with a DDoS-prevention firewall application, we can do that. We can pop that in and have it literally target a specific service or function within your network. Platforms like Contrail Cloud and OpenStack help orchestrate that and make it simple and automated to do.

By virtualizing, we're able to really target security into the elements that service providers need, at the places they need, and help them add a second or third layer of protection to the network that they might not have had previously.

Monica. In a virtualized network, operators can deploy resources when needed, and this brings cost savings and flexibility.

Steve. Exactly. In a virtualized environment, you are able to quickly upgrade software packages and really start to talk about zero-day attacks and how you can prevent things before they start.

Monica. And for security, time is absolutely crucial. Another crucial thing is to make sure that your network is reliable. In the virtualized environment, how do you measure the reliability?

Steve. Certainly this is a shift for the industry in general. Before virtualization, reliability was really built in at the individual planes or at the box level.

What Juniper provides is an NFV platform. We do look at reliability, system availability, and high availability at the system level. Some components have device- and blade- and box-level reliability, but really the vision here is to build system-level reliability. If an x86 server fails, there's nothing catastrophic: another instance can spin up; traffic can be redirected and load balanced across a pool of appliances.

We can have geo redundancy at the system level, as well. If things happen in one area, we're able to seamlessly adapt the cloud to the underlying performance requirements or issues of an individual VNF: virtual connections, physical connections, physical lines, etc.

Our architecture was designed from day one to be able to really look at reliability from an all-out system level, which is in line with what we're seeing from cloud service providers today. That's certainly the architectural approach of a Google or Amazon. It's certainly going to be a critical factor as we talk to our telco customers who are asking these same questions.

One of the key things that we're doing is starting to tie together the virtual network and the physical network. We've got a tremendous amount of analytics coming out of the physical network. And Contrail Cloud NFV platform have a tremendous amount of analytics about the virtualized network – about who is connected where and what flows

are going where, what performance we're seeing there.

The next step is to tie those two bits together. If there is a failure, is it just a VNF that failed or is there something wrong at the switch port or x86? And we can start to look at the correlation between that data to help the technicians and the network operations department monitor and effectively respond to network problems. The goal is to have a lot of automated processes and simply provide more detailed, more pointed explanations as to what is going on.

Monica. Virtualization is a great technology breakthrough, but it also changes the way operators work internally, their culture, the way they do things. Is this slowing down adoption?

Steve. Certainly. It's a huge topic of conversation with pretty much every customer I meet with, and the topic of a lot of the feedback we're getting from the field. There is a conversation happening in the service provider community between the IT departments, which traditionally run the internal systems for the service provider, the enterprise services, and the network side of the house, which is really looking at how to leverage the power and the benefit of virtualization to become a more agile service delivery environment.

We see different companies going different ways – a lot of this is still up in the air. One of the big shifts we are seeing, though, is really a migration. It's certainly, on the network side of the house, much more of an OpenStack, open environment and much more of a DevOp style of programmability, specifically within the network and NFV.

Monica. Mobile operators are more used to having proprietary software solutions, interfaces, hardware. The all-IP environment is still new to them. Open source is even one step beyond that. Are operators comfortable with that?

Steve. The pendulum definitely swings back and forth. I think the pendulum has certainly swung much more towards an open side of the house. What you're going to settle for is a managed yet open environment.

Companies are providing a packaged open source or an OpenStack environment that is open yet structured, and service providers can certainly use it.

This isn't going to be the Wild Wild West. The network is the business for the service provider. Therefore, they have to deliver a level of reliability. They must have the systems in place to be able to do all of these things.

Frankly, I think the mobile service providers in particular have even more to gain by moving to virtualization. There is a lot of talk about virtualizing the EPC or IMS infrastructure. That's a fairly straightforward process. Let's take what we've got and virtualize it. In the Gi-LAN services complex, we're going to start to see a move away from physical appliances to a much more virtualized environment. This is an opportunity to drop in – as I was talking about earlier – new services, new capabilities, new customization opportunities, where the service provider can actually start to drive value.

The Gi-LAN is more like a pure IP environment, and it is a little outside the domain of the 3GPP. I think this is really where we're going to start to innovate and capture value for the service providers, and help them really drive the benefit out to their consumers. Soon customers actually see that, hey, my network behaves differently because of this technology. That's when I think we're all going to benefit.

Monica. Do you see any difference in the type of reception you get from operators in different geographies or of different sizes?

Steve. Everybody's moving at a different pace. A lot of times it's competitive pressure. LTE is an interesting cross section of what we're seeing from the marketplace itself. One of the statistics I like is that something like 82%–83% of LTE subscribers in the world are in Japan, Korea and the US.

While there is a whole slew of LTE networks out there, the reality is that only a couple of places really rolled up their sleeves and jumped in.

I think the same applies in NFV. A group of companies came out and said, "We're targeting this. We're ready to go. We want to start building it in." There's a lot of activity, a lot of planning that's happening. We're hearing a lot of 2020 or 2018 vision planning. How does the network evolve over the next four to six years to take advantage of this?

A handful of companies have been public, such as Telefonica. Their CTO announced plans to virtualize some 30% of network functions by 2016. AT&T has rolled out their Domain 2.0 vendor program – which Juniper is proud to be a part of. There are some companies that are really taking a stance and saying this is something that's going to happen, and we're going full force into it. A lot of other companies are saying, "I've got a lot of other problems on my plate. As the technology matures, we'll get ready for it."

Monica. In terms of what's going to be virtualized first, how do you see that developing? It's going to be a long process.

Steve. In the mobile space, technologies like IMS and EPC are the starting points. There are two elements to that.

One is that a lot of mobile providers are still growing. We're starting to see the move to VoLTE, so IMS has become more and more important. EPC capacity demand and subscriber growth continue to be there. If they can grow their network more quickly, grow their network more cost effectively using virtualized technologies, that's a great place to start for mobile operators.

The other thing that's happening is that operators are starting with a virtualized version of an existing physical appliance. It's the first small step towards nirvana, where everything is fully automated.

It's like George Jetson, if you remember The Jetsons. He would sit at his desk and all he would do is push a button. In a fully automated environment of the future, George's job was the button pusher. We can envision a world where everything is fully automated and services spin up and down, and subscribers are managed. But we've got a long way to go. Step one is that instead of buying an EPC in a standard rack, I buy EPC software and run it in a rack of x86s.

Next step is to start to add some automation and SDN. These steps will take time, absolutely, but we're starting to see the first step with NFV, to virtualize these network functions. Next step is to bring in something like a Contrail Cloud, or an orchestration system that starts to automate some of that process.

Monica. In closing, what should we expect from Juniper, moving forward? What is the next direction you're going into?

Steve. I think you're going to see the ecosystem get bigger. You're going to see us continue to push the idea of a high-availability, open NFV platform. We're in conversations with multiple companies in the service orchestration space, the VNF space, the partner space, the service delivery space. We will continue to beef up Juniper's platform, and the value that Juniper brings as our complement of NFV, and how we really interact with the entire ecosystem to bring this value to market.

Glossary

3GPP	Third Generation Partnership Project
API	Application programming interface
BSS	Business support system
CPE	Customer premises equipment
DDoS	Distributed denial of service
DPI	Deep packet inspection
EPC	Evolved Packet Core
ETSI	European Telecommunications Standards Institute
IMS	IP multimedia subsystem
IP	Internet Protocol
IT	Information technology
KPI	Key performance indicators
LAN	Local area network
LTE	Long Term Evolution
MVNO	Mobile virtual network operator
NAT	Network address translation
NFV	Network Functions Virtualization
OCS	Online charging system
OSS	Operations support system
PCRF	Policy and charging rules function
REST	Representational state transfer
SCG	Small-cell gateway
SDN	Software-defined network
TDF	Trusted Data Format
vEPC	Virtual EPC
vIMS	Virtual IMS
VLAN	Virtual LAN
VM	Virtual machine
VNF	Virtualized network function
VoLTE	Voice over LTE
VPN	Virtual private network

About RCR Wireless

Since 1982, RCR Wireless News has been providing wireless and mobile industry news, insights, and analysis to industry and enterprise professionals, decision makers, policy makers, analysts and investors. Our mission is to connect, globally and locally, mobile technology professionals and companies online, in person, in print and now on video. Our dedication to editorial excellence coupled with one of the industry's most comprehensive industry databases and digital networks leads readers and advertisers to consistently choose RCR Wireless News over other industry publications.

About Senza Fili

Senza Fili provides advisory support on wireless data technologies and services. At Senza Fili we have in-depth expertise in financial modelling, market forecasts and research, white paper preparation, business plan support, RFP preparation and management, due diligence, and training. Our client base is international and spans the entire value chain: clients include wireline, fixed wireless and mobile operators, enterprises and other vertical players, vendors, system integrators, investors, regulators, and industry associations.

We provide a bridge between technologies and services, helping our clients assess established and emerging technologies, leverage these technologies to support new or existing services, and build solid, profitable business models. Independent advice, a strong quantitative orientation, and an international perspective are the hallmarks of our work. For additional information, visit www.senzafiliconsulting.com or contact us at info@senzafiliconsulting.com or +1 425 657 4991.

About the interviewer

Monica Paolini, PhD, is the founder and president of Senza Fili. She is an expert in wireless technologies and has helped clients worldwide to understand technology and customer requirements, evaluate business plan opportunities, market their services and products, and estimate the market size and revenue opportunity of new and established wireless technologies. She has frequently been invited to give presentations at conferences and has written several reports and articles on wireless broadband technologies. She has a PhD in cognitive science from the University of California, San Diego (US), an MBA from the University of Oxford (UK), and a BA/MA in philosophy from the University of Bologna (Italy). She can be contacted at monica.paolini@senzafiliconsulting.com.