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5G telco cloud transformation: Aligning people, process and technology

By Peter Cohen

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Introduction

5G offers 'a long tail' of services and monetization opportunities

Arden Media's Telco Cloud Forum gathered together an international cohort of stakeholders in 5G to discuss the issues facing Communication Service Providers (CSPs) as they move to cloud-native network operations. Telco cloud technical challenges start with deploying the 5G Core network itself, managing spectrum alongside 4G LTE and extending to the farthest edge of the network with new and emerging hybrid cloud deployment strategies. Those technical challenges aside, the evolving telco cloud also forces

carriers to re-examine their own operational processes. Those that pivot to cloud-native innovation and agility will be best positioned for success as 5G momentum continues.

Harnessing the power of the cloud

Telco cloud is all about people, process and technology – but mostly about people

One of the key messages from expert presenters at Arden Media's recent Telco Cloud Forum was, perhaps not surprisingly, that people are key to success. While the move to cloud-native network operations is relatively new for operators, it's old hat for enterprises and web-scalers; the technology works so

optimally that leveraging cloud investments for efficiency and revenue generation is much more about strategic organizational changes.

"As we moved into the cloud and embraced this transition to cloud, one of the biggest changes that we dealt with was a change in how our team was structured," Verizon Vice President of Information Technology Abby Knowles explained. Specifically, she said team members had to shift from being generalists to being specialists. "This was a hard thing for us because we had been so focused on doing it one way. What we found [after the shift to specialization] was that we were



able to actually scale faster. As we created infrastructure experts, as we created applications experts, as we created folks who focus on performance, we were able to learn it faster. We were able to turn it up faster. We made sure that even as we functionalized, we were able to keep focus on the customer.”

Lessons learnt by Rakuten Mobile

This is a familiar story to Rahul Atri, who has served as managing director for Rakuten Mobile, a greenfield Japanese market entrant that built its 4G and 5G networks using telco cloud and Open RAN architectural and operational

principles. “The most important challenge as an operator or service provider you face today is the skill set of the team,” he said. “Talking about the people, I think we are in a transition stage with telecom where we need the expertise of the SMEs who are coming from a typical telecom domain but also the shift of understanding of the cloud, how to run the IT workloads, rather than the bare-metal or the legacy applications. For us it was challenging because when you try to hire somebody and they say, ‘We come from webscaler,’ or, ‘We come from telecom,’ “there’s no skill [that]” kind of intersects.”

To solve this issue, Rakuten Mobile set up a center of excellence to re-skill or up-skill employees. This started by understanding management of physical infrastructure, hypervisors, cloud telemetry coming from virtual machines and the application layer. “You have to make sense of it,” Atri said. “I think the largest change or biggest impact we had were people and how they adapted. I think we were able to create something magical in Rakuten just because of that.”

Atri also acknowledged that sometimes things break. But, “Be bold. You don’t have to have a plan B. No decision is bad.”



Rakuten Mobile's Center of Excellence team, managed by Rahul Atri

Image courtesy of Rakuten Mobile

With telco cloud, "It's no longer a technology conversation"

Operators are, at varying speeds, embracing the scale, speed and economics of telco cloud as they look to make the most of 5G network investments. In the first part of this piece, we heard loud and clear from operators that, in this move to the cloud, people and organizational changes can be more vexing than the massive technological shift that necessitates them.

Now for the view from the vendor side.

Google Cloud is busy striking deals with operators with much of the action focused on linking



"Be bold. You don't have to have a plan B. No decision is bad."

*Rahul Atri, Managing Director
Rakuten Mobile*

together enterprises to 5G at the edge. If Dish is an indicator, there's more to the relationship between hyperscalers and operators than just joint go-to-market. And it's time for operators to make moves. But how do they play out in practice?

"We take the conversation pretty immediately to operations, people, process, and organizations because we are at the point now where it's no longer a technology conversation," according to Google Cloud's Kevin Shatzkamer, digital transformation officer for telecom. "We understand the technology at this point. The technology has been well-proven; it's been well-proven inside a telecom environment and operating environment."

He continued: "I think when you really start to see technology adoption ramp and you start to see the hockey stick curve towards the upper right, it happens when you spend less time proving the technology is viable and more time focused on how do I organize myself to operate this technology at scale?"

Shatzkamer, who also serves as managing director of Google Cloud's Telecom, Media and Entertainment Center of Excellence, said operators need to make an operational shift from vertical silos to horizontal layers. Reflecting

on conversations with operators, he said a common need is to put conversations and decisions into contained buckets. "The first one is a set of decisions that actually need to be made early on in the process and they'll set the direction for how you'll adopt cloud and migrate into the cloud. The second is a set of decisions... where it turns out you don't need to make some of these decisions right now. They can be delayed until later and you can move forward with imperfect information. I think that's tough, traditionally, for telecom to absorb. The third one... it's the set of decisions that you actually think you need to make that actually turn out not to matter at all."

VMware sees a "fundamental shift" in operator thinking

This decision-making process also applies to Dish, which is building a brand-new, cloud-native network using AWS's cloud infrastructure and following multi-vendor, Open RAN specifications. VMware is providing Dish with its Telco Cloud platform for cloud-based network operations and services management.

VMware VP of Professional Services, EMEA Chris Hill, building on Shatzkamer's commentary, said Dish has "a mantra, which is fail

quick[ly]... let's not try and be in possession of all the data and all the surety before we begin a new phase of the project." The attitude, rather, is 'let's get out there and learn how to do it as we go.' I think that's a fundamental shift in how operators and consumers need to think about this. But we've been through that same change in the data center."

Building on that, he added, "We've been delivering clouds into the data center, enterprise, private cloud, multi-cloud solutions, for a long time now. It is about people,



"It's about culture, not just tooling processes and technology."

Alexis Koalla, Head of Operations for Transformation towards Agile and DevSecOps, Orange

process, technology, and actually... probably the easiest one of those to achieve is standing up a technology platform. You really do have to focus on the people piece and the process piece."

Hill also pointedly noted that, at the end of the day, investments in telco cloud are all about driving efficiency and revenue. "I think it's worth keeping your eyes on the prize as well, which is about competitiveness in a 5G/edge cloud world."

DevOps culture — the cornerstone of telco cloud

DevOps is the cornerstone of modern software engineering and essential to cloud computing. DevOps promises faster software deployment and higher quality results by making the process continuous and integrated. 5G's core architecture gives network operators the ability to test, deploy, and scale new services at hyperscaler velocity, but the cloud-native design also presents operational challenges.

Going cloud-native means thinking cloud-native. DevOps embeds both an operational and cultural shift in organizations. First, a broad overview. While each business may use different approaches, the DevOps process incorporates seven unique steps:

1. Planning: Determining the scope of work and resources needed.

2. Development: Writing code.

3. Integration: Individual developers merge code changes into a central repository.

4. Monitoring: Entailing the process of overseeing the entire process from soup to nuts, including testing and verification.

5. Feedback: Internal reviews of how the systems within the DevOps process function.

6. Deployment: The production push involved in publishing the actual software code, again occurring continuously as iterative improvements are made.

7. Operations: Working hand in hand with monitoring, operations oversees the process to make sure everything stays on track.

French telco Orange is in the midst of integrating DevOps into its operations. Alexis Koalla is responsible for implementing those changes as head of Operations for Transformation towards Agile and DevSecOps. (DevSecOps is a security-focused DevOps process.)

"It's about culture, not just tooling processes and technology," Koalla said.

Orange identified four challenge areas in its DevOps transformation process, starting with

integration with external vendors and managing new heterogeneity. Continuous integration and deployment requires a reorganization of source code repositories and better alignment with external vendors. Aligning efforts with external vendors and stakeholders presents challenges, as does the development of Infrastructure as Code (IaC).

DevOps reduces toil

Jorrit Kronjee, vice president of Engineering, CaaS at KORE Wireless said that automating manual, repetitive tasks is key to continuous integration, deployment, and testing. “DevOps encourages to reduce toil,” he said.

KORE automates tests throughout the development and production pipeline to verify builds and integration.

“Doing continuous integration early will help our developers see how their change affects other components of the architecture, allowing us to address integration issues early,” he said.

“Not all developers enjoy being on call for things they didn’t build themselves,” said WorkingGroupTwo CTO Werner Eriksen.

DevSecOps culture enabling the Telco Cloud transformation: Four stakes and challenges

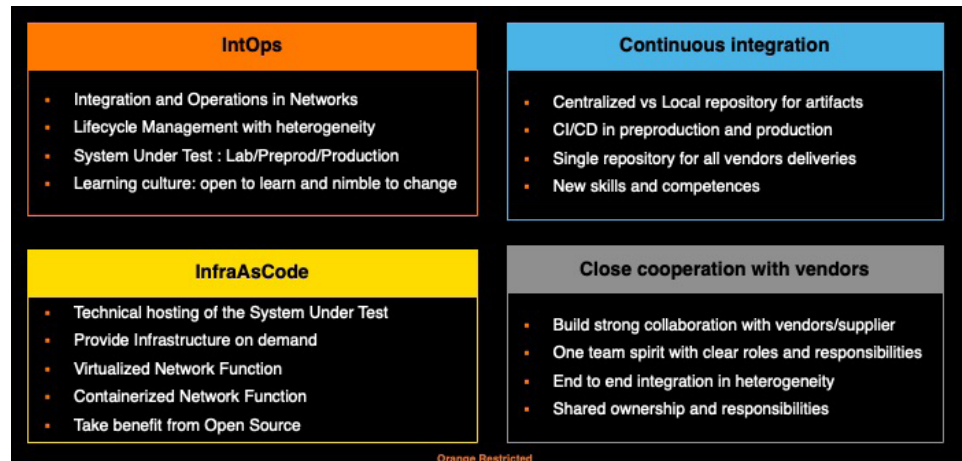


Image courtesy of Orange

Successfully integrating DevOps means having a flexible and transparent process.

“So even if you have the ability, you need to make sure the tooling is in place for people to feel safe and sound about being on call when they’re needed,” said Eriksen.

Orange is taking a modular approach to the development of its telco cloud, said Koalla, intended for both internal and external needs. Orange’s full-stack development approach helps it meet dynamic and variable operational requirements.

Internally, the telco cloud needs to align with IT operations. But the same core technology also needs to work in private 5G

enterprise deployments, for edge computing, and other customer-specific services. The key, said Koalla, is building a federation layer which exposes common Application Programming Interfaces (APIs) tied to each individual deployment infrastructure.

“At this layer you can have several federators,” said Koalla. “And on top of that, we will have the services offered by the market.”

This reduces cost, simplifies access, and helps stakeholders share mutual benefit, said Koalla.

“We are not alone. We cannot build things alone. If we want to succeed with federation, we need a strong collaboration with vendors and suppliers,” he added.

Three fundamentals of a cloud-native infrastructure strategy

Best practices for Kubernetes use in the telco cloud from a telco cloud architect

Scalability is the essential characteristic of any cloud native-service: compute, storage, memory and other factors are deployed at scale, on demand. Telco cloud is no different, said Neil McRae. Except the scalable unit is the network itself. Neil is BT's group chief architect and managing director, Architecture and Technology Strategy. Being cloud-native means more than just containerizing an app and orchestrating it via Kubernetes, he said.

"My team might disagree with me, but I kind of know what I'm talking about when it comes to building infrastructure," he joked. McRae sketched out some fundamentals for Kubernetes-based cloud-native telco infrastructure with Viavi CTO Sameh Yamany during a Telco Cloud Forum 2022 fireside chat.

BT's network is engineered to provide services at scale, said McRae. "Voice, TV, broadband, mobile," McRae said. He described them as "the heart of everything that we do."

"In the new cloud-native world we see many kinds of solutions for those four key... core capabilities, and we see them being treated as pets," he said.



Network functions are cattle, not pets

What does animal husbandry have to do with the cloud? Pets get special treatment and a soft bed in the house to sleep on. Cattle and other livestock are moved en masse. Network functions need to be thought more of like cattle, less like pets.

Applications ported to the cloud may only be partially native, McRae explained, which sharply limits their scale. App bottlenecks include vendor-locked deployment scripts, incomplete abstraction from infrastructure, and the decomposition of applications into functions rather than true cloud-native infrastructure. Partial automation is another roadblock.

"If we really want to think about

cloud-native, the big driver... is around automation," McRae said. The only way of building network functions simply won't scale to the cloud-native world, he said.

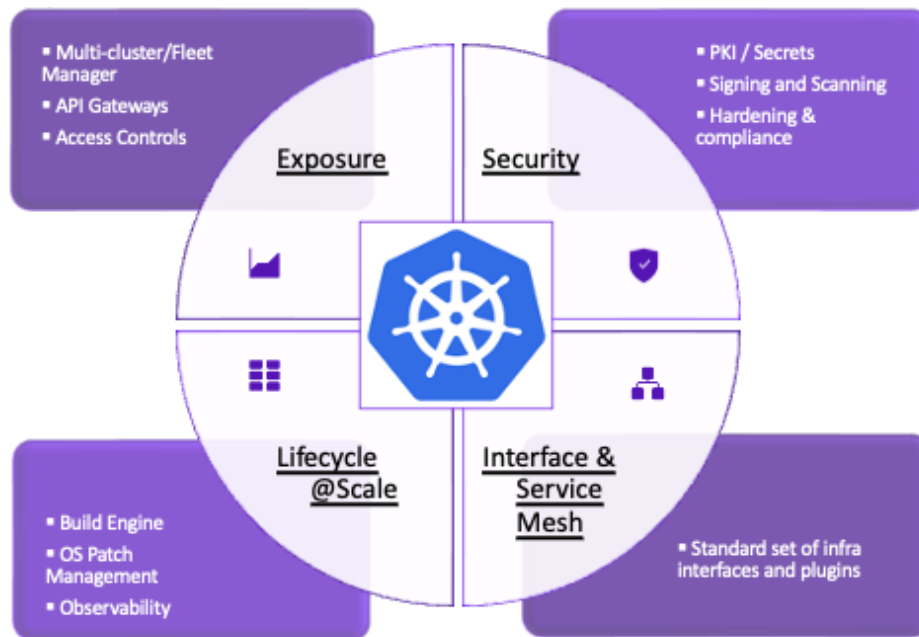
The four pillars of cloud-native infrastructure

Exposure, security, lifecycle at scale and interface and service mesh comprise the "four pillars" of BT's Kubernetes app strategy within the telco cloud. Exposure starts with Application Programming Interface (API) gateways, access controls and fleet management.

"The world is moving to complete application abstraction," said McRae.

Security is crucial, especially given the scale of services, as are

Kubernetes – ready at scale



BT's Kubernetes app management strategy.

Image courtesy of BT

issues like hardening and regulatory compliance.

“You’ve got potentially billions of individual components on a cloud-native infrastructure,” he said.

The third pillar, lifecycle management, is where the build engine is managed.

“Observability is really important,” said McRae. “Is everything working the way it’s supposed to? And can you see it? If you can’t, how do you know it’s working?”

The fourth pillar, interface and service mesh, is also linked to observability, said McRae. “Different infrastructures have different

interfaces, plug-ins to each other,” he said.

Containerization at scale demands consistency

Vendor-specific containerized apps can create multiple challenges for telcos starting with their security posture, restricted operational visibility, possible dependencies on other libraries and apps, and patch status.

“My challenge to vendors is around security and software version and making sure that every piece of software is running the latest patch level,” he said.

BT has its own process to make

sure every app that touches the telco cloud passes muster.

“We put them through our own filter, if you like,” he said. BT signs all software images, and integrates with their own logging and monitoring tools.

“So we go from a land of pets to a world of cattle,” said McRae. “And we can manage those cattle really well.”

Ultimately all of this is a work in progress for BT and for everyone in the business. McRae acknowledges that BT’s journey to telco cloud is early on, and that some of foundational technology is still quite novel for its use.

“It’s early days. Kubernetes isn’t ten years old yet, and it’s already running the world.”

How to transition from Non-Standalone to Standalone 5G Carriers and other stakeholders offer insights

The rollout of 5G continues globally. The next step for carriers is the transition from Non-Standalone (NSA) 5G to Standalone (SA) 5G. 5G SA promises operators a telco cloud with the flexibility and scalability to create new services and new revenue opportunities. But 5G SA implementation is rife with technical and operational challenges.

Globally, CSPs are in different



“The most secure system is the open system.”

Sinan Akkaya, Director of RAN Engineering, AT&T

stages of 5G SA implementation and there are already lessons to learn.

First, do no harm

Sinan Akkaya, director of RAN Engineering at AT&T, cautioned carriers to consider standalone 5G's Dynamic Spectrum Sharing (DSS) carefully. There's work to be done figuring out the appropriate load balance between 4G and 5G traffic. “We generally don't think about the spectrum,” he said.

“You need to think about optimizing your dynamic spectrum sharing features in such a way that you

should not hurt the customer who's on a 4G platform,” said Akkaya.

Carriers need to keep their focus on satisfying all customers, not just ones making the 5G transition themselves.

“Customer experience is not necessarily only about 5G and SA. We have a mix of customers. Probably 70 to 80% globally, maybe even more subscribers today, do not have SA-compatible phones,” Akkaya said.

DSS enables carriers to deliver more 5G services to compatible equipment, but under peak network conditions may hurt 4G LTE performance.

“This is pretty much the only challenge in front of us right now,” said Akkaya, describing it as “a RAN problem.” Akkaya said that AT&T is working through the problem with new RAN features and optimization techniques.

“There's going to be quite a lot of optimization effort going into this,” he added.

Get more from dual-core

Chandresh Ruparel, senior business united director of 5G and Wireless Core Infrastructure, Network and Edge Group, Intel, noted the trend towards dual mode architectures which enable 4G LTE and 5G SA cores to work side by side.

“The vendors are coming up with some very innovative solutions,” he said. “You can have elasticity, in terms of the capacity you can handle for 4G and 5G subscribers.”

The switch to a cloud-native standalone 5G core requires carriers to rethink key performance indicators beyond user plane and control plane performance, he said.

“All the capabilities in the infrastructure need to be available to address the KPIs [key performance indicators] around performance,” he said.

Security, automatic network resource failure recovery and other factors must be exposed, observed, measured and optimized, he said.

Reduce latency everywhere

Latency isn't just a problem to solve at the near and far edge, advises Sadayuki Abeta, general manager of Radio Access Network Development, NTT DoCoMo. The company activated 5G SA service for its enterprise customers in 2021 and will activate 5G SA service for consumers this year, he said.

Abeta sketched out in detail how NTT DoCoMo's SA network is set up.

“We have two sub-six bands: 3.7 and 4.5, with 100 megahertz [mHz] bandwidth for each. So we can provide more than 1 Gbps in single-band



“We need to improve end-to-end latency.”

Sadayuki Abeta, GM, RAN Development, NTT DoCoMo

operations. This is much higher than LTE single-band,” he said.

Reducing end-to-end latency is a pressing challenge for NTT DoCoMo, said Abeta. There isn’t a single roadblock — the company is taking a holistic approach. It’s looking at ways to improve latency in transport, core network and processing between the server and terminal, he said.

NTT DoCoMo is investing resources to reduce latency throughout the network to optimize 5G SA performance. “We need to improve end-to-end latency,” he said.

“So not only to improve the radio side if it’s not ok, but we need to

improve the processing to provide good applications,” he said.

Standards and a strong ecosystem

AT&T’s Akkaya had the last word. He encourages carriers to get the most out of network automation. We’re not going back to the 1990s, he warned, with “hundreds of engineers working behind the curtain.”

Akkaya also thinks transparency is important to carriers when it comes to security. Transparency enables problems to be identified and resolved that much faster. “The most secure system is the open system,” said Akkaya. “I’d rather have an open system, an open platform that is challenged every single day, so that I have the most secure system.”

Akkaya also told carriers to mind the environment. The massive scale of distributed standalone 5G telco cloud architectures needed to power the near and far edge may create power-hungry “BBU farms.”

“We’re not only living in the age of AR, VR and autonomous vehicles but we’re living in age of climate change,” he said. “Power consumption models need to be under control. We need to be very smart about it.”

The third is for the industry to organize around strong, meaningful

standards. “We need a strong ecosystem, and a strong ecosystem will definitely rely on standards,” said Akkaya.

Verizon ‘leaning in’ on Open RAN

Verizon VP talks experience with vRAN, Open RAN outlook

Verizon Vice President of Technology Planning and Development Bill Stone was crystal clear that, for it to live up to the promise of changing the world, 5G has to be programmable. As such, Verizon has invested heavily in virtualization, the importance of which Stone said “cannot be overstated.”

“5G is beginning to touch nearly every industry sector,” Stone said. “We believe it will impact the global economy in a profound way and dramatically improve our global society...We’ve already gotten a strong glimpse into future solutions that will be built on top of our 5G network...This remarkable technology is paving the way for unprecedented innovation that will reshape the world.”

Virtualization and programmability

In terms of steps Verizon has taken to make its network programmable, Stone called out the operator’s efforts to consolidate, simplify, modernize and virtualize

its core network first, then its access network. “The move to cloud-native and container-based virtualized architecture has led to more flexibility, faster delivery of services, greater scalability, and significant cost efficiency. With that virtualized baseband unit, we will lay the foundation for more computing functionality, to move that to the edge of the network. We will be able to rapidly respond to customers’ varied latency and computing needs.”

In addition to its 5G network deployments, Verizon has also invested in deployment of mobile edge computing infrastructure with hyperscaler partners, including AWS for public MEC. In August 2020, Verizon completed a fully-virtualized, end-to-end 5G data session. Then in September 2020, Samsung Networks, a leader in virtualized RAN, won a major deal with Verizon.

“The importance of virtualization in the modern network cannot be overstated,” Stone said, listing off high-value 5G applications that “all heavily rely on the programmability of virtualized networks. Virtualization is critical for advanced operations and services like network slicing and edge compute, which require a programmable network with the ability to move functions



and operations across the distributed network.”

From vRAN to Open RAN

“vRAN,” Stone said, “we view that as an important precursor to O-RAN.” And with O-RAN come benefits derived from new competition and innovation in the RAN vendor ecosystem, deployment flexibility, faster innovation, and greater service options, he said.

Discussing the difference between Open RAN for a greenfield build versus integration into a brownfield network environment (a key talking point in Open RAN discussions), Stone said the edge held by incumbents is institutional expertise and a robust, established

network to depend on when building something new.

“When it comes to some of the considerations, I would say one of the bigger challenges in a virtualized environment is integration... [And] extensive testing is a must as is tight collaboration between operators and suppliers to integrate functions. The more suppliers that are introduced into the RAN environment, the higher the interoperability testing complexity. Not a challenge to admire but one that we are aggressively committed to solving.

Stone concluded: “An Open RAN architecture delivers the great benefit of additional competition, innovation and cost efficiency across

the radio access network but those benefits serve as the strong incentive for operators to move forward with Open RAN. We at Verizon are leaning in with our vendor partners to help solve the technical challenges associated with this evolution.”

Public vs. private cloud

5G has long been described as the first generation of cellular born in the cloud. While that’s a reductive statement, operators are moving network functions and operational processes into the cloud, there’s a heavily-debated question: Which cloud; public, private or both? Discussing the operator’s plans for hosting network functions in the cloud, Stone was clear that Big Red’s network will reside in a private cloud that Verizon fully controls.

Stone told Tantra Analyst Founder Prakash Sangam, “When it gets to the telco workloads, including what we’re talking about here today with vRAN and O-RAN, Verizon remains committed to disaggregating hardware and software and selecting the best available partner for each of the components. That’s our path forward. AT this point, our plan is to build, optimize and leverage our own telco-grade private cloud for both our core and RAN workloads.

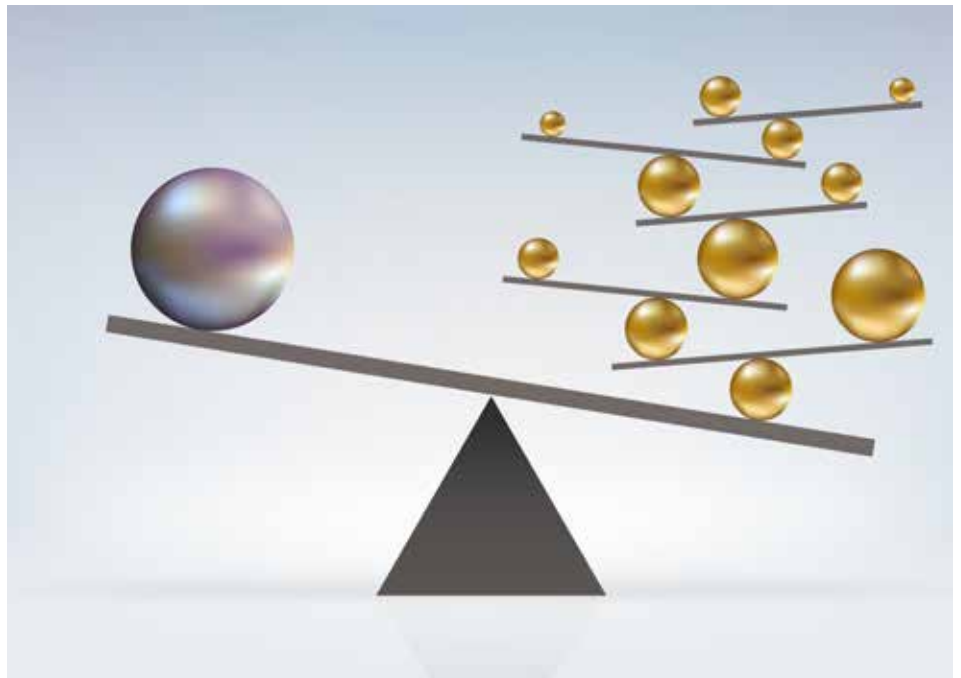
We’ll certainly continue to monitor other dynamics in the marketplace but I’ll just say, Verizon sees economic and operational benefits with our own Verizon cloud platform that will enable us to identify opportunities and scale fast.”

That stands in contrast to what Dish is doing with its greenfield build in the U.S. that’s seeing the new market entrant rely on AWS for hosting network functions. But that’s not to say Verizon isn’t working with hyperscalers. The operator has arrangements with the big three – AWS, Azure and Google Cloud – on various mobile edge computing-related initiatives, both public and private.

The Open RAN balancing act

As for Open RAN, Verizon is bullish on the evolution of its vRAN toward open, standardized interfaces. But Stone acknowledged that the multi-vendor of Open RAN increases testing timeframes and costs, as well as adds complexity to the system integration piece.

Stone said Verizon will “play a big role” in integration. “There’s going to be increasing complexity and integration costs associated with integrating different components at scale and ensuring interoperability and the level of reliability that customers demand. One of the bigger challenges in a virtual environment is integration where



more focus and responsibility is on the operator and we accept that responsibility at Verizon... Extensive testing is a must. We've learned that. As is tight collaboration between the operators like Verizon and suppliers to integrate the functions. The more suppliers that are introduced into the RAN network, the higher the interoperability testing complexity."

Taking on Open RAN integration and allaying concerns around trading capex for system integration opex is something of an emerging sub-industry within the telecoms sector. Rakuten Mobile picked its components, worked through integration, then built a cloud-native Open RAN network in Japan. From there, the firm spun up Rakuten Symphony to sell that model, including hardware and software components. Similarly, NTT DoCoMo is rallying its ecosystem partners into the 5G Open RAN Ecosystem (OREC) which takes a fairly similar albeit (currently) less productized approach.

What does Verizon think of that model? "Extensive testing is a must," Stone reiterated. "It doesn't really matter to me where that testing is done. If it's done extensively before it's brought to Verizon, that certainly has value... That being said, one

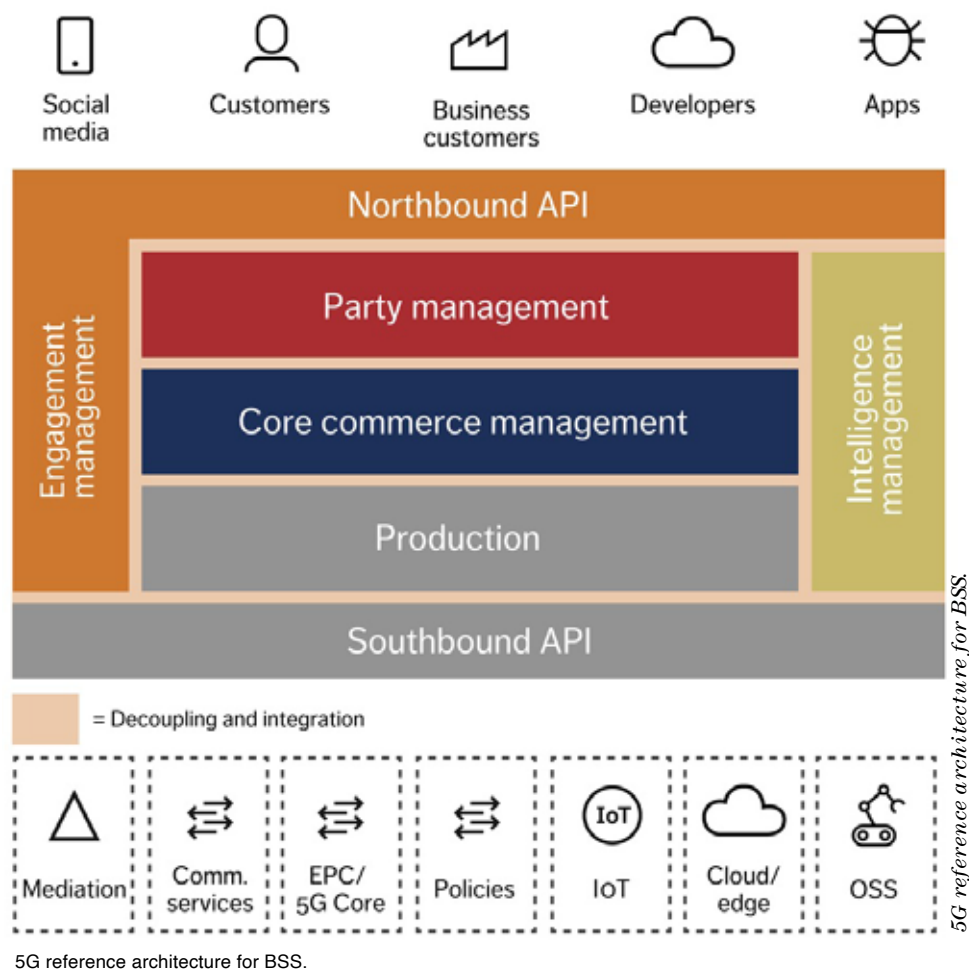
of the other things I've mentioned today is that our plan is to be actively engaged in evaluating the different components and selecting the best in class... So there's a little bit of conflict between those two approaches."

He continued: "I happen to believe somewhere between those two things is where this is optimally going to balance."

New generation OSS/BSS — orchestrating a complex machinery

Cloud-native 5G needs cloud-native OSS/BSS to manage it

The cloud-native 5G Core unlocks boundless business opportunities for CSPs and challenges to the OSS/BSS technology and processes that help them monetize their businesses. The evolution to 5G also unlocks new monitoring and analytics data



5G reference architecture for BSS.

to help telcos manage their networks more effectively. OSS/BSS challenges must be updated: the old way of doing business will not scale to the cloud.

This requires a fundamental OSS/BSS rethink. CSPs need to get the balance right with basic network operations, integrating Virtual Network Functions (VNFs) with Cloud Native Functions (CNFs), aligned and operating perfectly within an increasingly distributed hybrid cloud network. Vendors must deliver on 5G's promise of decreased time to market for services creation, rapid innovation and an improved customer experience. Introducing automation and leveraging AI in a hybrid network function environment is a necessary but daunting task.

Arvinder Anand, VP of Architecture, Technology and E2E Solutioning Digital Services, Ericsson, summarized the challenge facing CSPs. "What is needed is a major transformation in the industry's ways of working and the implementation of proper technology to support it," he said.

There's no single technology fix for this, Anand said. This challenge needs to be addressed more holistically. "Rather, a consistent platform that is designed and optimized to

the required ways of working as needed," he said.

Change presents opportunity

"I don't think we would be reinventing our networks or the business systems around them if it wasn't for the fact that the business models themselves are changing," said Mark Price, CTO of MATRIXX, whose company makes cloud-native converged charging and billing platform for telcos.

Business transformation is an essential process of the telecom industry and 5G is no different, he said. "This may be the largest one so far but it certainly isn't the first time."

Telecom networks are optimized for select, broad "killer app" market segments, he said, like smartphone and video streaming. "Networks are optimized for throughput, the business systems are optimized to suit that," he said.

Telcos should look beyond smartphones, Price said. Operator success with 5G hinges on recognizing new micro-segmentation opportunities and having the agility to support them.

"Cloudification is also an opportunity to simplify the complexity of the OSS landscape," said Mauro Starineieri, head of Global OSS &



"Cloudification is also an opportunity to simplify the complexity of the OSS landscape."

Mauro Starineieri, Head of Global OSS & MANO Competence Center, ATOS

MANO Competence Center at ATOS. OSS and BSS software has become stratified, a combination of off-the-shelf and bespoke components which will be unmanageable in a cloud-native environment, he said.

The experts agreed that agility is the key to CSPs unlocking new 5G business opportunities.

"We have to be agile, we have to be flexible. We can't support any single business model. We need to be able to support models that are not even envisioned yet," said Price. Being

able to visualize those opportunities and meaningfully understand how services are being consumed is essential, he said.

“We have more information being exposed than ever before, so analytics are essential to delivering on the promise here.”

Going cloud-native

Price and Starineieri emphasized the need for cultural adaptation within telcos making the 5G cloud journey. Being able to pivot to cloud-native technology successfully requires cloud-native approaches in every aspect of the business. This cycle starts with the DevOps process that’s at the center of the cloud app lifecycle - concepts like continuous integration and continuous deployment (CI/CD). By embracing these concepts throughout all aspects of the business, they said telcos will be better poised for future success.

Ericsson’s Anand summarized the existential question facing CSPs as they develop OSS/BSS systems to support 5G services and business opportunities.

“I think service providers should ask [themselves] certain questions,” said Anand. “Where is our company in the technology and skills in terms of cloud journey, what steps are we

taking for cloud-native applications and CI/CD, and how will our infrastructure support orchestration and automation that needs to be embraced very early in the phase to get the best out of this transformation?”

How to develop a 5G ecosystem in the telco cloud era

Identifying new stakeholders and new opportunities

A rising tide raises all boats, or so the saying goes. No operator can do this on their own — 5G requires a full ecosystem to reach its ultimate potential. 5G is creating a burgeoning ecosystem of app makers, service integrators, platform developers and others who are rushing to fill the voids they recognize. 5G’s potential has no limit and the telecom industry must seize this opportunity to redefine its business model to monetize 5G.

CSPs are shifting their own commercial and operational principles to align with 5G transformation. The new 5G technologies which will drive telecom industry growth for the next decade requires a rethink of stakeholder partnerships, especially in an era where some stakeholders are also competitors. Grant Lenahan, partner and principal analyst at Appledore framed the challenge and the opportunity.



“Our approach is to co-create with key players.”

Sissel-Henriette Larsen, Director of Strategic Partnerships, Telenor

According to Appledore’s analysis of the 5G state of play for telcos, incremental revenue growth requires integration and service partners who can provide value for customers by simplifying and securing that process.

“So we believe these are going to be composable or building block-type services. They’re going to be multi-party and they’re going to be dynamically changing,” he said.

Larsen said that this process starts for the Nordic telco by identifying key stakeholders in local markets

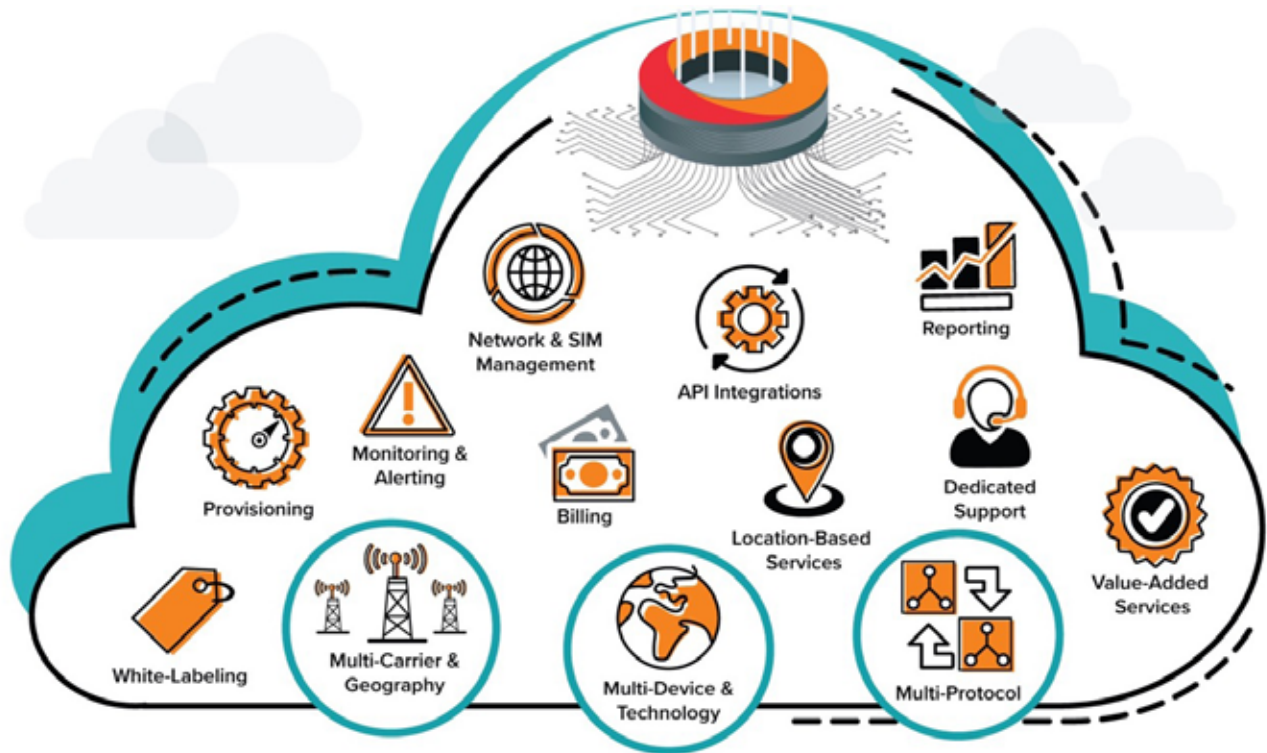


Image courtesy of KORE Wireless

KORE One is a streamlined IoT enablement platform with elastic engines and services.

and providing a tailored approach.

“Our approach is to co-create with key players,” she said. Stakeholders have a better perspective from their vantage about how to maximize local market opportunities, she said. For Telenor, it’s Industry 4.0 verticals in Nordic countries, and shipping and port logistics verticals in Southeast Asia.

KORE’s role as an IoT connectivity services provider requires it to navigate connectivity with more than two dozen service providers. There’s

strength in that combination, said Steven Baker, VP of product management at KORE Wireless.

“When we can take all those providers and make them part of a single product that we’re deploying globally, each of them gets a piece of that action if you will,” Baker said.

Baker and Larsen underscored the importance of piloting as a way to test the waters first-hand.

“The best way I’ve ever experienced to deliver a good reputable market-based product is to take

a stab, but work with a customer through the process to gain that understanding,” said Baker.

Jack of all trades, master of none: Carriers can’t be expected to develop subject matter expertise in every single emerging vertical opportunity. The trick, said Baker, is to recognize the abstraction points where you can provide value and work with partners to develop the rest.

“We partner for many of those, probably 40% of those, so we’re driving value out to some other

folks,” he said.

This formative point in service development and ecosystem is representative of the evolution of telecom to 5G. We’re in deployment mode, said Stephanie Burris, marketing manager at Viavi Solutions.

“It’s greatly focused on deployment right now because that’s where the industry is,” said Burris. “So we’re seeing these ecosystems pop up and these use cases pop up, and we are helping the different players ensure end-to-end connectivity and service quality.”

For connectivity solutions

providers like Viavi and KORE, the increasingly distributed network topology employed by 5G presents emergent challenges. Like network allocation, said Burris.

“We need to make sure network resources are prioritized. There are a lot of demarcation issues that might happen as you roll out those use cases,” she said.

Lenahan used the “only one throat to choke” analogy to describe the customer’s perspective: The vendor that delivers integrated services is the one customers will complain to when it doesn’t work right.

Burris agreed that’s an issue from the retail customer end, but sees enterprise relationships differently. Many enterprise customers already have a relationship with a hyper-scaler or hyperscalers as well as a telecom provider.

“So they might have two throats that they want to choke,” she joked.

“There are so many challenges but also many opportunities for new players to come into this,” remarked Telenor’s Larsen. She pointed to Telenor’s lab testing facilities as an important resource for their ecosystem partners.



Three cybersecurity considerations in the 5G era

CSPs operate essential communications infrastructure for billions around the world. As new cybersecurity threats emerge, the safe and secure operation of networks isn't simply a customer service exercise: It is a matter of national security. The 5G telco cloud, the near and far edge, and RAN disaggregation efforts such as Open RAN all present new risks for network operators to mitigate.

Embrace transformation

"The 5G network itself actually has some really critical security enablement and protections built in, from the subscriber to the radio

to the core. As an application across the cloud, the 5G network in its own right has [set] a pretty high bar," said Matt Beal, senior VP of software development for Oracle Communications.

Beal noted that the cloud-native 5G core requires telcos to adopt the cybersecurity disciplines and best practices intrinsic to industrial and enterprise cloud IT management. He provided a long list of examples that Oracle says are critical:

"The insistence on automating everything. Disposability: That ability to have something in one moment and completely erase it and re-instantiate it. Externalization of configuration: Putting that control into a very, very secure external

area, so you've got additional layers of security."

Beal said that best cybersecurity practices for carriers involve multiple tiers of security and management, drawn from both telco and cloud.

Patricia Díez Muñoz, head of Network, IT Platforms and Customer Devices Security for Telefónica, points out that the 5G telco cloud is built on open principles.

"Not just Open RAN, we have open broadband, open devices. We have open everything," she said.

"If it's something that is well-defined, well-implemented, and you apply this into a security governance, it shouldn't be any more insecure than any other technologies



The 5G ecosystem relies on several security stakeholders.

Image courtesy of ENISA

and implementations you will be deploying,” she added.

Support standardization and certification

“Standardization is the key element, the set of rules we can follow, and we decide how strict we can be,” said Vassiliki Gogou, cybersecurity expert with ENISA, the European Union Agency for Cybersecurity.

Gogou explained that cybersecurity certification, which is where ENISA is focusing its attention on 5G at present, provides steps to follow, a harmonized approach to protection.



“The key is implementation.”

Patricia Díez Muñoz, Head of Network, IT Platforms and Customer Devices Security, Telefónica

“The certification is going to be the seal of trustworthiness for 5G,” she said.

“As 5G risks in general are addressed, certification is not a panacea. We know that. But it’s a decent way forward to the trustworthiness of citizens,” said Gogou.

Securing the app supply chain and managing that lifecycle presents challenges to CSPs as they introduce new network functions and updates. Carriers must be vigilant against exposing security risks through unpatched software or through dependencies with other apps and services.

“We have specific security requirements depending on the solution,” said Díez Muñoz. Depending on the solution, Telefónica will perform specific security testing on elements and end-to-end services to assess security vulnerabilities.

Security standardization is top of mind for Telefónica as they continue RAN disaggregation efforts.

“The key is implementation, because at the end, any equipment or network function, or any solution, may be secure or insecure depending on how you implement it,” said Díez Muñoz.

This is particularly important against the backdrop of the

telco cloud’s open architecture. Díez Muñoz explained that Telefónica’s global cybersecurity team maintains constant vigilance on patch and update issues, and continuously does critical vulnerability testing to detect issues.

In the end, Beal says carriers need to be thoughtful at every level about how cybersecurity is implemented, tested, and monitored. And their vigilance needs to be constant.

“Shockingly, it’s still something like phishing and basic consumer attacks that can undo the most secure network if you’re not careful,” he said. “So make sure you have your entire discipline lined up, coordinated, and automated where possible.”

Conclusion

Orchestration is a foundational concept in telco cloud starting with Kubernetes. Network and automation, zero-touch networking and orchestration is essential to getting cloud services to work at scale. Orchestration is also going to be the key for CSPs going forward: orchestrating business processes with an eye toward agility, innovation and transformation to capture the promise of 5G. ((•••))

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