



WHITEPAPER

Maximizing Wireless Utility Through **Software-Based Networks**

DIFFERENT BY DESIGN™



The speed of wireless innovation is undeniable

There's no arguing the fact that cellular communication has transformed our lives. That pace of innovation across the internet space is nothing short of remarkable. We, as an industry, have moved from the days of analog communication where it was difficult to find a signal and voice was your only medium, to today's world where it could seem foreign not to be able to stream a movie in ultra-high definition to multiple devices simultaneously. Many may see this, peak speeds driving endless entertainment, as the pinnacle of progress. However, there is much, much more to come in terms of innovation. Software-based flexibility will move the wireless industry out of the hardware-based system realm and into next generation architectures where the speed of 5G innovation can truly shine.

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Network Customization – it all starts with software

Imagine if someone told you that you had to build your home with parts only from one supplier – their wood, design, paint, carpet, even fixtures. Sure, a house could be built, and it would be safe and functional. However, the lack of customization and the ability to add the buyer’s preference or superior third-party offerings into the mix would be lost. In almost all cases the ability to provide a high level of choice will make the whole outcome better – a brighter paint color, a more efficient water heater or a custom chef’s kitchen. These parallels can be easily made with locked hardware systems vs. pliable software-based systems.

Comparing this with a clean-sheet, future-ready approach, the impacts and ability to change with the market become clear. Nearly all networks in the world today have a geo-based model, one that requires a single vendor to operate their Radio Access Network (RAN) from baseband to radio. It took years to reach a level of open core interfaces that could interoperate with different vendor RANs. And that’s where the open interfaces stopped to a large degree, at the S1 interface between the core and RAN. We are finally seeing breakthroughs that are changing in the form of software-based systems. While the proposition of swapping out entrenched hardware can be a scary prospect, the flexibility and functionality gained simply can’t be ignored. Software-based cellular networks are undoubtedly the future.

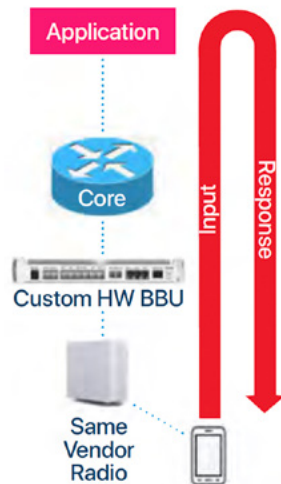
THE CLEAN-SHEET, FUTURE-READY NETWORK Virtualized RAN, Common Hardware and Edge Compute Primed

Traditional Network Architecture – Linear Hardware

Traditional networks have bandwidth and latency issues that can’t be solved, only maintained at great expense

Custom parts manage custom functions

Single vendor core, radio, edge compute (MEC) – limited choice

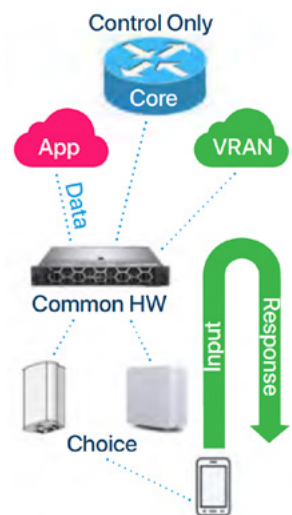


Next Gen – Software, COTS and Choice

Common hardware critical to supporting edge compute model

Bring functions close to users, increase security, deliver high bandwidth, low latency - 5G critical

Enable network owner choice as vendors/functions evolve

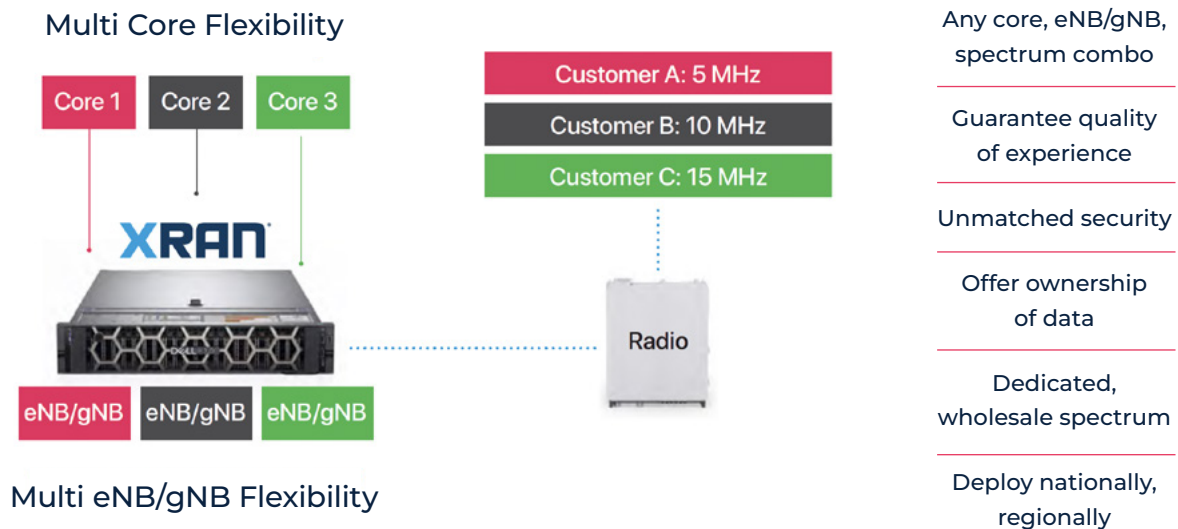


Software-based wireless networks drive flexibility to the extreme

Understanding the need for mix-and-match capability, industry standards bodies have provided paths to network flexibility through open interfaces as well as features like Multi-Operator Core Network (MOCN) and Multi-Operator Radio Access Network (MORAN). Both provide a level of utility, but fall short of providing the peak of flexibility – the option to offer ownership, end to end, of a network to a third party. Using the same standards-based approach with the high level of software flexibility offered, a new flexible pivot is available – the Multi-Operator Owned Network, a new concept called MOON.

A MOON framework, particularly effective in private wireless deployments, drives virtualization deep into the architecture in the form of virtual eNodeBs (4G LTE) and gNodeBs (5G NR). Much like what vLANs did for WiFi virtual eNodeB and gNodeB networks allow specific partitioning at unprecedented levels – specific spectrum, location, etc. In this scenario, noted in the below diagram, the spectrum owner in this case may provide ownership through wholesaling of the network in its entirety, allowing an application or wholesale purchaser to bring their own core, run functions independently through a flexible, software-based baseband unit, through a common remote radio head and out to the end user over a piece of spectrum that is matched with the user’s need.

END-TO-END FLEXIBILITY





NETWORK SLICING

- Technology specific, fragmented experience
- Can't offer custom ownership
- Limited data access, co-mingled traffic
- Loosely differentiate experience, no guarantee
- Can't provide data ownership to customers
- Must fill up a single pipe through connections

COMMODITIZED

This pivot point of virtual eNB and gNB provides entirely new constructs to selling and monetization. Noted in the table below, the level of network parsing becomes much larger than ever available before. While 5G standards support new levels of network slicing, the Multi-Operator Owned Network framework provides this, and additional functionality, back through the

MULTI-OPERATOR OWNED NETWORK

- Fully supported – 4G and 5G simultaneously
- Opens direct access to customers
- Premium for data ownership, security
- Guaranteed quality of experience
- Sole access to all data/KPI
- Ability to slice within a dedicated pipe

**COMPLETELY
DIFFERENTIATED OFFERING**

4G LTE network. Elements of ownership, including the full flow of the data and KPIs, become realized. Most importantly, the ability to own a pipe end to end guarantees a level of quality of experience not available today.

5-DIMENSIONAL NETWORK INTELLIGENCE

- 1

MULTI-NETWORK

Provide or utilize a wholesale core, providing billing and other control layers.
- 2

MULTI-TENANT

Add multiple tenants in a virtualized eNB or gNB, creating 2 compartmentalization between networks on a single piece of common hardware.
- 3

MULTI-SPECTRUM

Take different pieces of spectrum, each suited to different 3 performance, and allocate them according to the end user network need.
- 4

MULTI-CLASS

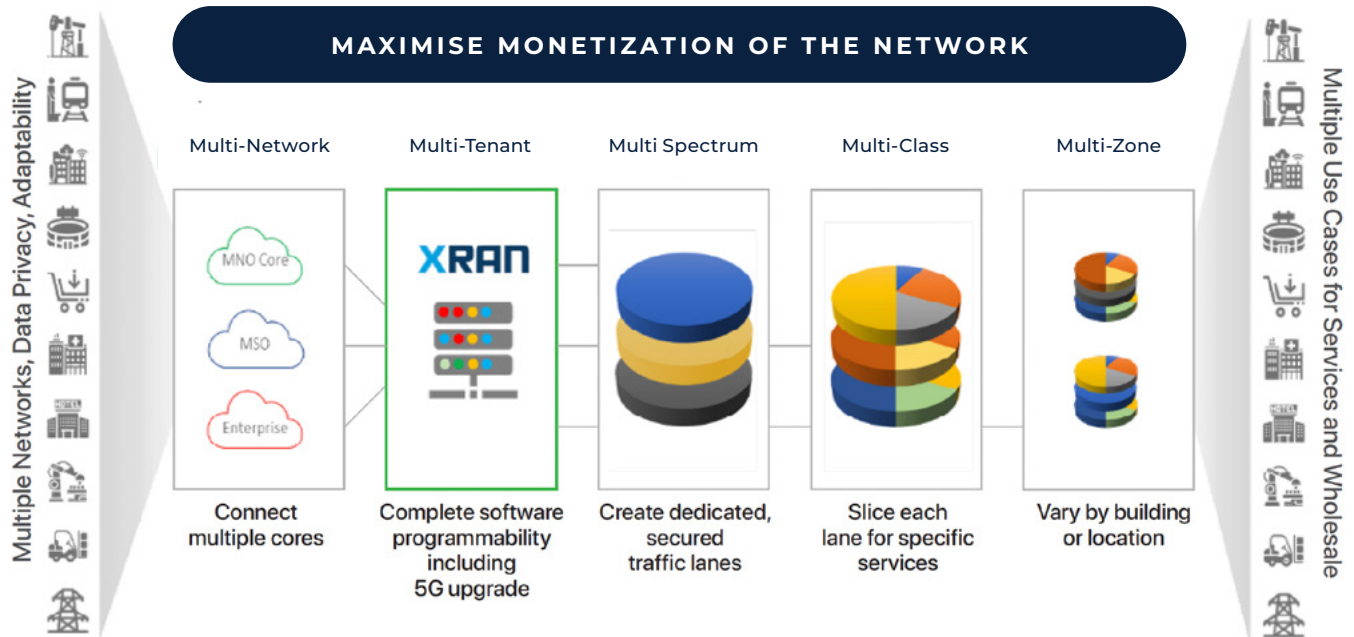
Employ slicing within your allocated eNB or gNB along with the 4 allocated piece of spectrum. In essence, add traditional slicing capability to users on your network as a sub-function.
- 5

MULTI-ZONE




Vary your network experience as granularly as needed. 5 Different areas of the network will require different experience levels (e.g., dense urban vs. rural vs. large venue).

Current slicing models allow a prioritized piece of a single, shared pipe. Multi-Operator Owned Network models completely segment a pipe – core to device. This becomes increasingly interesting not only to network operators, but also provides utility to application providers. Specific networks can now be architected in software for resource-based needs, like a high-coverage,

low-bandwidth IOT network. Taking the alternate extreme, applications can now own direct customer relationships in dense areas providing functions like AR/VR or cloud gaming where high bandwidth and low latency are critical.



Software-based flexibility is great but what can I do with it?

Application	Requirements	Implementation
Cloud Edge Gaming 	Low latency, high throughput, own the end-user relationship	Gaming application co-located with software-based wireless solution given specific network slice or dedicated spectrum exclusively for gaming, ensuring throughput and latency needs as well as the ability to own the end-user relationship, including all data processed through the platform, billing, etc. unavailable today.
MVNO Network Wholesaling 	Fully partition and slice spectrum, data ownership	For networks with a desire to truly wholesale, software-based wireless solutions allow the ability to bring your own core or use an existing core. Specific spectrum resources can be selected based on the location and application. low band, small slices for IOT reach or mid/high band larger slices for higher-performing application needs like video delivery or AR/VR.
Smart Manufacturing 	Application flexibility, paired with ultra low latency edge compute	Enterprises can deploy a software-based wireless implementation using either high bandwidth CBRS or available, partnered license spectrum through a service provider. Applications placed on local compute, on premise, with ultra low latency application working in a local breakout, closed loop fashion (sub 5ms latency). In parallel, network slices enable any mix of throughput and latency need including high def security cameras (high bandwidth) or mission-critical push to talk (low latency).
Large Venue Dynamic Usage Profiles 	Highly segmented quality of service, dynamic profiles	Highly segmented quality of service, dynamic profiles Large venues can create multiple service profiles to manage diverse events. Common venue elements include wireless concession purchasing or ticketing, push to talk secure comms or smart parking digital displays, all via sliced lanes on a private network. During a sporting event, slices are established to support instant replay video to fans, team app/video channels or sideline comms. When hosting a concert, the profile dynamically flips to offer in-concert videos to fans, dedicated comm lanes for production companies or simulcast audio to smartphones or suites without the need for extensive wiring.

Conclusion

As networks evolve, the flexibility to differentiate the end-to-end experience will be paramount. The only solution to the level of specificity and dynamic nature of network changes will be to employ a software-based solution set. For executives and IT management considering their connectivity infrastructure and ways to leverage the new private wireless spectrum, it is crucial to consider the reliability, scalability and flexibility of future systems. New technology innovations have taken these systems far beyond basic access point hardware designs and will provide you with an ability to maximize your use of not only available spectrum, but new ways to monetize it through wholesale models. In 2020 and beyond, no clean-sheet network build, including private or wholesale-driven networks, should extend the limitations of custom-built hardware that limit choice.



About JMA Wireless

JMA Wireless is the leading global innovator in mobile wireless connectivity solutions that ensure infrastructure reliability, streamline service operations, and maximize wireless performance. Employing powerful, patented innovations, their solutions portfolio is proven to lower the cost of operations while ensuring lifetime quality levels in equipment and unrivaled performance for coverage and high-speed mobile data.

JMA Wireless solutions cover macro infrastructure, outdoor and indoor distributed antenna systems, small cell solutions, and virtualized RAN software. JMA Wireless corporate headquarters are located in Liverpool, NY, with manufacturing, R&D, and sales operations in over 20 locations worldwide.

FOR MORE INFORMATION:

jmawireless.com

JMA Corporate Headquarters

📍 7645 Henry Clay Boulevard
Liverpool, New York 1308

☎ +1 315.431.7100

☎ +1 888.201.6073

✉ customerservice@jmawireless.com

🌐 www.jmawireless.com

