Three keys to success:

Preparing your mobile network for 5G

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Understanding the unsung heroes of 5G adoption:
Most 5G press coverage focuses on radios and the lightning fast data speeds they will deliver, along with possibilities for exciting new apps.

But on the flipside of those exciting developments are the extensive infrastructure changes that operators will need to make in order to help their customers make the most of a new generation of mobile networking.

In this eBook, we examine the unsung heroes of 5G adoption and the changes you will need to make at three key levels: access (HetNet), transport (xHaul) and core (Mobile Core).

- **HetNet:** This brings together multiple access technologies and generations (2G, 3G, 4G, 5G, Wi-Fi). The key is to achieve seamless mobility. Advanced self-organizing networks (SON) orchestrating and optimizing all these radio networks.

- **Mobile Core:** An evolution in the central part of the telecommunications network into a virtualized, distributed services platform that will be critical in helping operators place service functions where they are needed most.

- **xHaul:** Bringing together existing fronthaul and backhaul capabilities to create a unified IP network. This unified network will transport all radio access technologies (licensed and unlicensed).

Each of these elements requires a tight approach to technological implementation and business integration. Yet across all of these three areas, one message rings true with consistency – 5G is about creating a new enablement platform for the delivery of business-ready services.

Enterprises and service providers – be they traditional, web-based or newcomers to the market – will see 5G as a way to launch new services quickly and easily on behalf of their customers. That can only happen if you start thinking about the key elements of your mobile networks now.

As we will see in this eBook, providers that focus on HetNet, Mobile Core and xHaul will be able to use 5G as an agile platform from which to deliver new business services quickly and easily.

HetNet: Heterogeneity as a new network normal

Operating in a multi-technology, multi-operator, multi-vendor and multi-domain environment

Any business that is serious about delivering new services to its customers from any location must focus on access and the seamless integration of new and existing technologies. To make the most of next-generation networking, you must be able to deliver pervasive broadband services with high levels of assurance and certainty.

The HetNet will play a crucial role, allowing your organization to make best use of existing architectures and newer, advanced technologies. This HetNet will encompass macro and small cells, licensed and unlicensed, and Wi-Fi functionality.

When compared to the narrow perspective of a conventional network, the HetNet will be multi-technology, multi-operator, multi-

vendor and multi-domain. By preparing for this heterogeneity you will be well placed to deliver the high-value services of 5G.

From silos to integrated networks that provide certainty

Your business will need to deliver an assured 5G service over what have, until now, often been siloed domains. Different teams – such as transport and core – have tended to work independently. That approach will have to change as we move forwards with a need to focus on orchestration. Automating these networks for scale and efficiency to support Digitization requires a Cloud-scale approach.

Through Cloud-scale virtualization and SDN we can break through these domains so the network functions as a single entity. This approach will provide for a higher quality experience end-to-end and is vital to deliver network slicing end-to-end.

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Many service providers have already begun on this path and are virtualizing areas of the network as it makes sense to do so.

The HetNet will cover a number of domains and will be delivered using functions from multiple vendors across multiple technology domains. As a mobile operator, you must strive to automate the management of this complex environment.

Virtualization will help to integrate resources, using the HetNet to automatically address the ever-changing demands on the network. Advanced SON will play a key role in optimizing and orchestrating these multiple radio technologies to maximize user experience.

Timeline for delivery: The key elements for HetNet success

1. Now – We are still early in the cycle, with most experts suggesting 5G roll out will take place from 2020. Many mobile operators currently face a complex mix, including a macro RAN domain, a growing small cell domain and an important – but possibly isolated – Wi-Fi domain.

2. Next – The key is the creation of a common HetNet framework across these operational domains, so you can help people migrate to 5G and deliver new tools and services. Integration is crucial to help you deliver and orchestrate the new capabilities associated to 5G.

3. On the horizon – The end goal is a HetNet that is automatically reconfigured to meet fast-changing business requirements. Self-organizing network tools currently help firms optimize a single domain. Heterogeneity requires an extension of these concepts, so you can analyze performance across all domains and automate service quality management.

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HetNet: Operational efficiency and delivering densification

Restating the business need for HetNet

The cost of delivering 5G services will need to be kept in check, especially as new base stations, sites and frequencies create increasing amounts of complexity. Operational efficiency will be paramount. You need to think about how you will automate the network to deliver a service that could change over time.

The popular means to manage networks is commonly to have long-term planning horizons, where operators might try and plan for changes across a twelve-week stretch. The legacy way of managing networks will not deliver the efficiencies required as we move forwards into the age of 5G.

Your organization will face a continually changing set of business objectives, subscriber behaviors and traffic profiles. You'll need to modify their processes and move from siloed domains into something much more integrated. That joined up form of access will be delivered through the HetNet.

Challenges and pain points

The clear demarcation between the team operating the core network, the RAN and the transport systems must evolve. To make the most of HetNet, the traditional barriers need to diminish, as a common framework is developed to manage functionalities.

The desired end point is a situation where all network functions can be virtualized, and sitting on virtualized and automatically orchestrated infrastructure. Real-time analytics will provide a further layer, helping you to derive instant information about how the service is operating and make automatic changes to ensure quality is assured.

That shift represents a transformation in terms of the required roles and core capabilities of existing staff. Technology is, in many ways, the easy part. Irrespective of the workload you virtualize, your move to the HetNet is going to blur traditional organizational boundaries. You must think now about how to prepare your teams for this shift.

Take network slicing as an example. For this you need to extend the capability – or slice – from the mobile core through the IP transport infrastructure and on through the radio access to the end devices. The true value of network slicing is a virtualized custom network that spans from the mobile core across the IP transport and on through the radio access. To accomplish this these multiple domains have to work as a single entity.

New value through new business cases

Remember that 5G provides much more than the promise of faster mobile broadband. While speed is important, the key differentiation from 5G will be in terms of the delivery of new services. New business cases are already beginning to emerge and will help mobile operators deliver value in a number of ways:

- Ultra-reliable, low latency – Businesses will face massive communications requirements that, instead of being consumer-facing, are more enterprise-focused. Operators will be able to use 5G to address new, vertical use cases. Operators must learn from Wi-Fi and think about how they will use these experiences to addresses new value

chains in 5G. Cisco's Visual Networking Index predicts that by 2020, around 90% of wireless traffic will be via Wi-Fi.

- Higher frequency opportunities – Evidence suggests new spectrum will be made available at higher frequency bands. If 5G is going to be successful, it is going to have to be used across a range of use cases and environments – and these new bands could help simplify deployment and avoid co-channel interference, particularly inside buildings.

Mobile Core: Moving from complexity to simplicity

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Supporting the business need for new services quickly

Customer demands change rapidly and your business must meet these requirements though the rapid creation of new services. That truism will resonate particularly strongly as 5G becomes prevalent. 5G, after all, is all about supporting new, better customer experiences.

The bad news, however, is it can be incredibly challenging today for mobile operators to introduce new network elements. It typically takes anything up to two years to introduce a new service – from the original conception in the marketing department to the roll out of services across the network.

If that sounds familiar, you need a change in approach. Rather than years, your business must be able to roll out new services in a matter of weeks. From idea generation to service implementation, your service needs to be ready quickly to maintain a competitive advantage.

New, scalable gateways

The mobile core will play a key role in your success. To support business change, your architecture is going to have to evolve to scale to the new demands of 5G. In an age of 5G, mobile operators will not be able to use the same monolithic gateway they might rely on today:

· Your present-day gateway talks to a range of different network elements to get subscriber profiles, charging information and relevant services

· Add in legal and security requirements and the present-day gateway is an extremely complex node
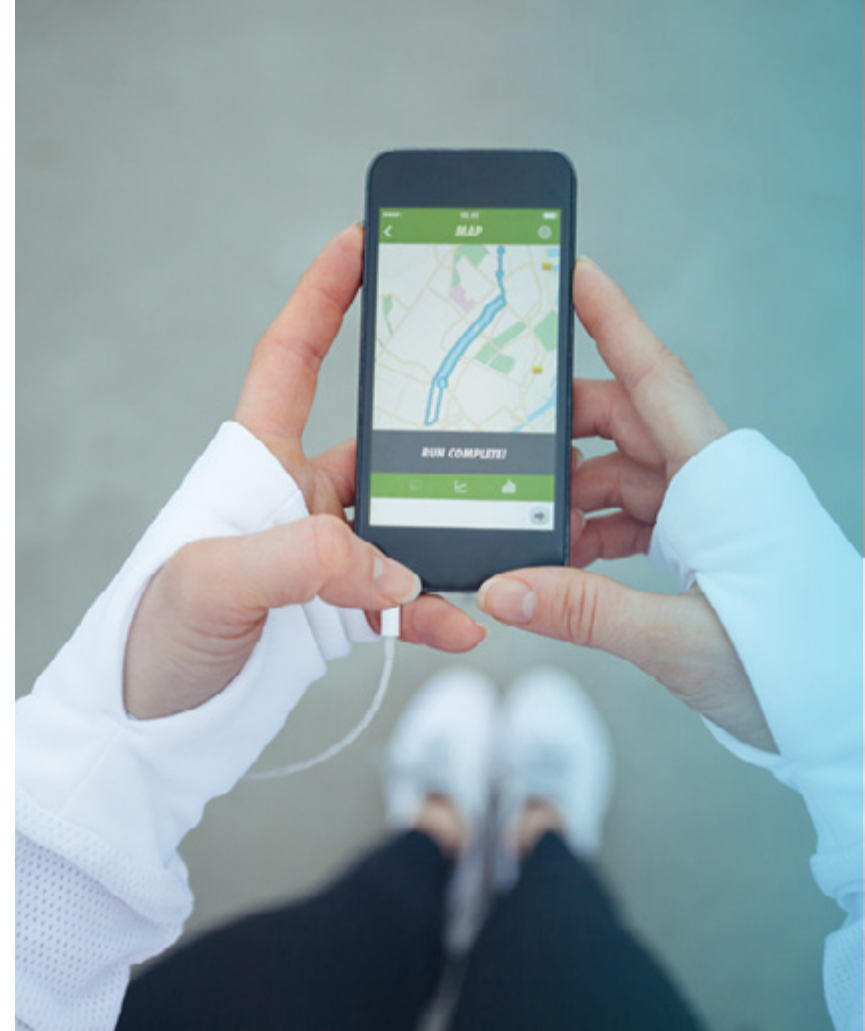
- There are other gateways to contend with too, such as access technologies from 4G Long-Term Evolution (LTE) and Wi-Fi.

To succeed, your business will have to provide a gateway that scales to terabits in throughput for 5G – but without having to extend the amount of connectivity in place at the back end. The last thing your organization needs to add is further complexity; what your business actually needs to create is simplicity. Automation and orchestration will make that simplification possible.

The aim should be to apply the benefits of digital technologies, such as the cloud and virtualization, in the network. The mobile core represents this change and represents an evolution in the central part of the telecommunications network into a virtualized service platform that helps operators place service functions when and where they are needed most.

The journey to a single user plane

There are multiple, connected layers in the traditional network, such as mobility, signaling and the control plane. By separating these layers you can make the whole process more efficient, because you only have to scale certain elements on demand. This is known as control, user plane separation (CUPS). This means you can position the management and control planes in a centralized data center, but place the user planes, SDN forwarders and service functions much closer to the customer location. This software-defined user plane will draw on any type of gateway, and add new services, in order to serve all customer demands on the network.

However, smart mobile operators and providers are already considering this transition. And the end result – in the form of the mobile core – will be a completely new approach to how connectivity is offered and how services are delivered, with minimal impact on the rest of the network.

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Mobile Core: Successfully creating a new operating model

New organizational structures

A move to network slicing represents a change in the operational paradigm. Rather than rolling out changes late at night, your business will be able to modify services on-demand and at any time. For the people that run networks, these changes represent a significant shift.

Some mobile operators are beginning to understand the scale of the shift and the need to up-skill their workforce. As we have already identified in our analysis of the HetNet, an increased used of automation will mean people's roles will become redefined and new tasks will need to be completed. It's essential that your IT teams are prepared for this shift in working practices and will be well placed to take full advantage.

Building for the future: Guaranteeing success

Regardless of access technology, connectivity is often still a fractured experience, both in regards to humans and machines. In an ideal world, the mobile core in 5G will enable a new form of seamless connectivity, where users compute, and storage will be able to hook into the network quickly, easily and securely.

Executives at your organization must understand that 5G is much more than a radio change – success, in fact, involves careful modifications across the network. The more adventurous operators will redefine their approach to service provisioning and go after new markets with higher levels of speed and efficiency.

You must also be sure that modifications work first time, every time. The creation of a virtualized service platform through the mobile core gives your business the opportunity to start developing organizational changes without operational risk.

When you want to rollout a new service you can create a network slice. Using that slice, if something fails in that new construct, it will stay isolated and not affect anything else on the network.

Key steps in moving towards the mobile core

New technologies, such as virtualization and the cloud, require a completely new approach to network architecture. Many elements come together to make a successful move to the mobile core. And that shift is by no means straightforward. These four key steps can help:

01
The movement of applications to the cloud means ownership can become less clear and the role of service level agreements can change. Be aware that you might have to act like a system integrator and bring together various technology elements.

02
That shift in responsibility can come as a shock. A lack of awareness can create significant delays in terms of your company's ability to roll out new network capabilities for 5G.

03
If you want to avoid the hassle of acting like a system integrator, look for a partner that can help you work across the entire network stack, including hardware, virtualization, applications and the top layer of automation.

04
Once you've got your business around the idea of running a virtual network, with access to highly trained staff, then you can start to think about the roll out of new, interesting capabilities for your customers.

xHaul: Transport that's ready for higher levels of bandwidth

Designing for lower latency, higher bandwidth and more flexibility

Transport networks also need to transition to Cloud-scale and become more distributed, virtualized and programmable in order to meet the challenging requirements of emerging use cases in an era of 5G. xHaul can play a key element and help you support the scale and radio requirements of the future.

xHaul involves the bringing together of existing backhaul and fronthaul networks to create a unified IP network. This unified approach to transport will provide support for key timing issues, like phase and frequency, as well as huge increases in scale, via IPv6 segment routing.

New business services through 5G will create big demands for bandwidth. Unified fronthaul and backhaul transportation, with a high degree

of centralization and virtualization, will give your network a new level of flexibility to meet fast-changing service requirements.

SDN is equally important in aiding this flexible, efficient operating model. An SDN controller providing application level orchestration will nicely complement Segment Routing to deliver new network services such as Low Latency or Disjoint Paths, that are key to deliver a superior 5G experience. This will be invaluable for networks coping with changing traffic demands and more sophisticated service requirements.

Checklist for success

Modern networks must be designed to support high bandwidth and low latency. As we will see later on, new services – connected to developments like video and the Internet of Things – place huge demands on network infrastructure. The scale of traffic will only

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increase as we move towards 5G, so the network you provide needs to be more predictable and controllable:

- You need high capacity in order to keep building out your networks as new requirements for business services come online

- You have to recognize that the ability to support automation, such as through software-defined networking, will help ensure traffic is routed correctly and the high quality of service for key services is maintained

Understanding the business need for xHaul

Your business might have already made progress in regards to the speed and quality of its networks. Most mobile operators are already aware of the need to support low latency and synchronization for modern applications, such as tactile IoT and virtual reality, particularly as ever-increasing numbers of individuals use their devices to work via the cloud.

However, the hard work is far from done. Modern applications rely heavily on low latency, sometimes as low as five milliseconds. Yet networks often remain static as demands continue to evolve. Many mobile operators, for example, do not support the enhanced standards of 4G LTE Advanced (4G LTE-A).

Your business must focus on enhancements now as 5G represents a huge step change. It isn't simply a switch that network engineers can turn on when the time is right. Preparatory work is crucial and your organization should be investigating xHaul right now.

xHaul: Supporting enterprise innovation through a Programmable network

Traffic networks that support business outcomes

A well-designed xHaul will be optimized, and that optimization will involve more than unified delivery over IP. Strong network partners will recognize that your business has already made investments in mobile and will help create a smooth infrastructure migration from 4G LTE/LTE-A to 5G.

To help your business take advantage of its already installed infrastructure, the framework should be designed with software-defined networking in mind. A cloud-based control plane will be a key element, allowing functions and decisions to be centralized and automated around key issues, such as caching and offloading.

Proactive network control will be also crucial to success, rather than reactive management. Segment routing can help operators find

the right balance between distributed intelligence and centralized programming. Underlying application-aware network slicing will ensure traffic is prioritized and high quality of service maintained.

Supporting video and IoT services

The rise of 5G means there is a significant need to invest in networks and supporting technologies. Successful mobile operators will create a tight relationship between technology spending and business outcomes. Investment now will help you to improve customer experiences and provide a competitive edge as new services emerge around video and IoT:

Video: Traffic is a huge issue for mobile operators right now, never mind in a 5G world. There is tremendous density in the network. Estimates suggest video might only account for 20 per cent of users but is accountable for as much as 80 per cent of traffic.

Addressing that 20 per cent would make a significant difference to performance. You'll need to understand how you can use technology, design and platforms to offload video traffic closer to the user. That successful offloading could have a huge impact on operations and profits.

IoT: Developments in IoT can be split into two key areas: massive IoT, where thousands of connected sensors – such as those in a smart meter – send huge amounts of data; and critical IoT, such as in a motor vehicle, where ultra low-latency and reliability are key to success.

These critical elements must terminate their services as close as possible to the user. Such closeness will help boost the quality of experience and make it easier for operators to up-scale their IoT programs in the future.

The journey to 2020 – four steps to success

The hype surrounding 5G continues to build; yet wide commercial availability is unlikely before 2020. You need to start evaluating your networks now and understand what kinds of changes will be required to deliver the high quality mobile services enterprises demanded. A number of key steps will help you ensure your business is on the right path:

01

Look at network timing: Frequency has been dominant but phase is becoming more important as organizations strive to cut friction and access services through applications as quickly as possible.

02

Transport network: Traffic growth will only increase, as will the variety of QOE demands. 5G Transport networks must both scale and intelligently handle the huge variety of requirements and slices that will be necessary, while controlling costs.

03

Transport platform: 3. Transport platform: You need to hold the capacity and coverage to cope with ever-changing requirements, with broadband access everywhere up to 1 Gbs per device and up to 10 Gbs to the cell site.

04

Quality of Service (QoS): Make sure you look at QoS from an end-to-end perspective, with low latency and delay variation. This is particularly important for critical services, such as the need for ultra-reliable communications in a fast-developing sector like electronic health.

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Forward thinking companies are looking to expand business opportunities across enterprise verticals. 5G, in short, is not just about enhancing the user experience, it is also about enhancing how businesses can use the mobile network to boost their competitiveness.

Mobile operators that focus on HetNet, Mobile Core and xHaul now will be able to use 5G as an agile platform from which to deliver new business services quickly and easily.

Plan for tomorrow, today

The move to 5G will occur sooner than you may think and the right preparation will be vital. Learn more about the steps your business must take to prepare for the next level of mobile networking by watching Cisco's webcast, 5G... Infinte Acceleration.

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