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RESEARCH STRATEGY REPORT

NETWORK SLICING: THE FUTURE OF CONNECTIVITY IN A 5G AND FIBRE ERA

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About this report

In this framework report, Analysys Mason provides a definitive overview of network slicing.[1] We examine the technologies and platforms used for network slicing, the evolution of the service models, and the opportunities and risks for new and old vendors, as well as service providers. The report outlines the three phases of evolution in this market – from its present stage to a post-2022, 5G-enabled landscape, which will define the future of connectivity.

The report is based on several sources, including:

- extensive interviews with vendor and CSP stakeholders
- service provider research that reveals the deployment intentions of about 50 communications service providers (CSPs).

KEY QUESTIONS ANSWERED IN THIS REPORT

- What is network slicing?
- What does network slicing require, both now and in the future?
- What are the opportunities for vendors and how do they need to adapt their model to take advantage of these opportunities?
- How does network slicing open the door to new service models, service providers and to vendors in non-telco markets (such as those providing data centre/cloud solutions)?

MARKET SEGMENTS

- Telecoms networks vendors
- Processor developers
- Virtualisation and orchestration specialists
- Mobile, fixed and converged telecoms operators
- Web-scale operators
- MVNOs
- Application service providers

VENDOR PROFILES

- Affirmed Networks
- Cisco
- Ericsson
- Huawei
- Juniper Networks
- Nokia
- Zeetta Networks

WHO SHOULD READ THIS REPORT

- Key decision makers in business and platform solutions – including CTOs, CMOs, and CEOs – who are formulating strategy for future product and service models and need to understand the implications of the new connectivity.

[1] Network slicing is a form of network virtualisation in which different services with different needs can be provided with different performance characteristics (such as latency, priority, or throughput) on a single physical network. It is an important feature of proposed 5G mobile networks.

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Executive summary

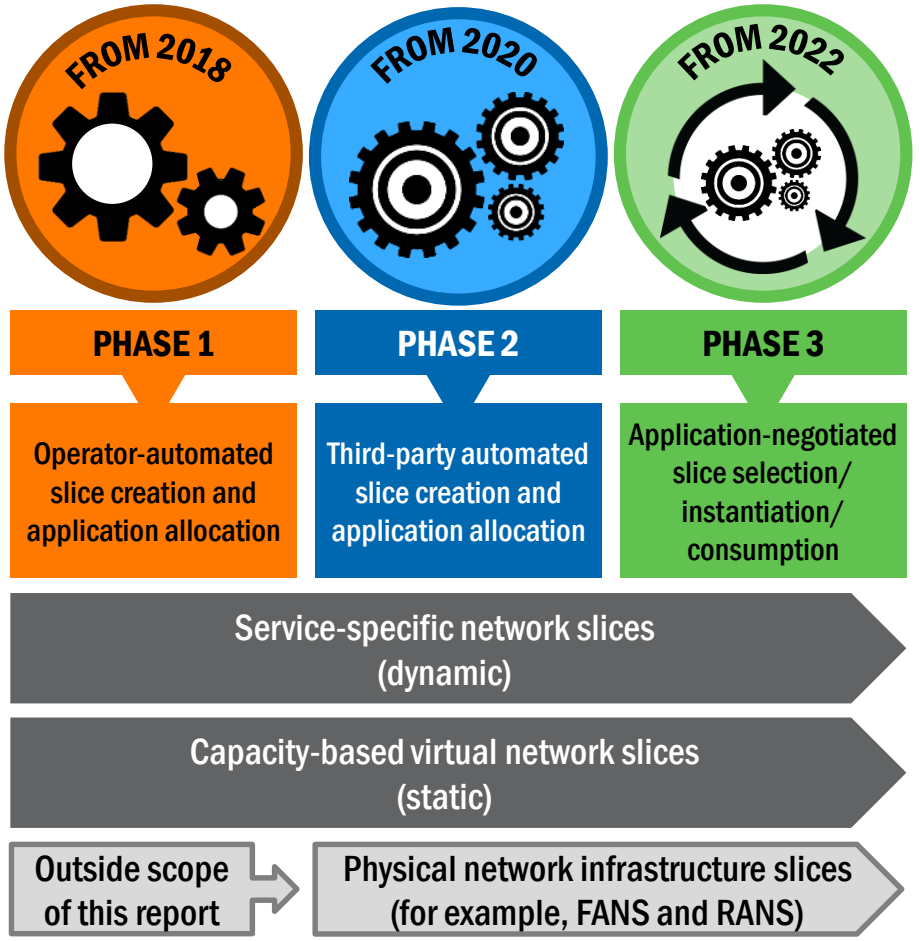
Virtualisation is laying the foundations for a telecoms network that will behave entirely differently to those of today. In future, applications will automatically navigate the optimal path through a flat, highly responsive network, representing the logical evolution of what we now call slicing. This will mean the end of the connectivity business in its current form, but there will still be opportunities for CSPs and vendors to profit from these changes, as long as they make preparations now.

Connectivity and services will be transformed in three phases. Phase 1 will use existing capabilities to support capacity-based slices and will focus primarily on cost efficiencies using improved operational automation, resource utilisation (including traffic management) and the limited use of virtualisation. Phase 2 will support single-tenanted, service-specific slices for a wider variety of users than Phase 1, while in Phase 3, the application itself will call up the resources it needs for an optimal end-to-end route. The monetisation potential lies in phases 2 and 3 for vendors and CSPs that develop rich platforms to support differentiated capabilities.

Network slicing will change the economics of the connectivity business. It may enable new providers to enter the market (including web-scale players) and vendors to compete with their customers by offering networks-as-a-platform that can be innovatively sliced.

This report, based on extensive vendor and operator inputs, provides a comprehensive overview of network slicing and its implications for vendor and CSP connectivity business models.

Figure 1: The network of the future will be sliced on different levels to support a wide range of service models and highly flexible resource usage



Source: Analysys Mason

Network slicing provides an end-to-end logical (virtual) network with dedicated capacity and/or other service-specific characteristics

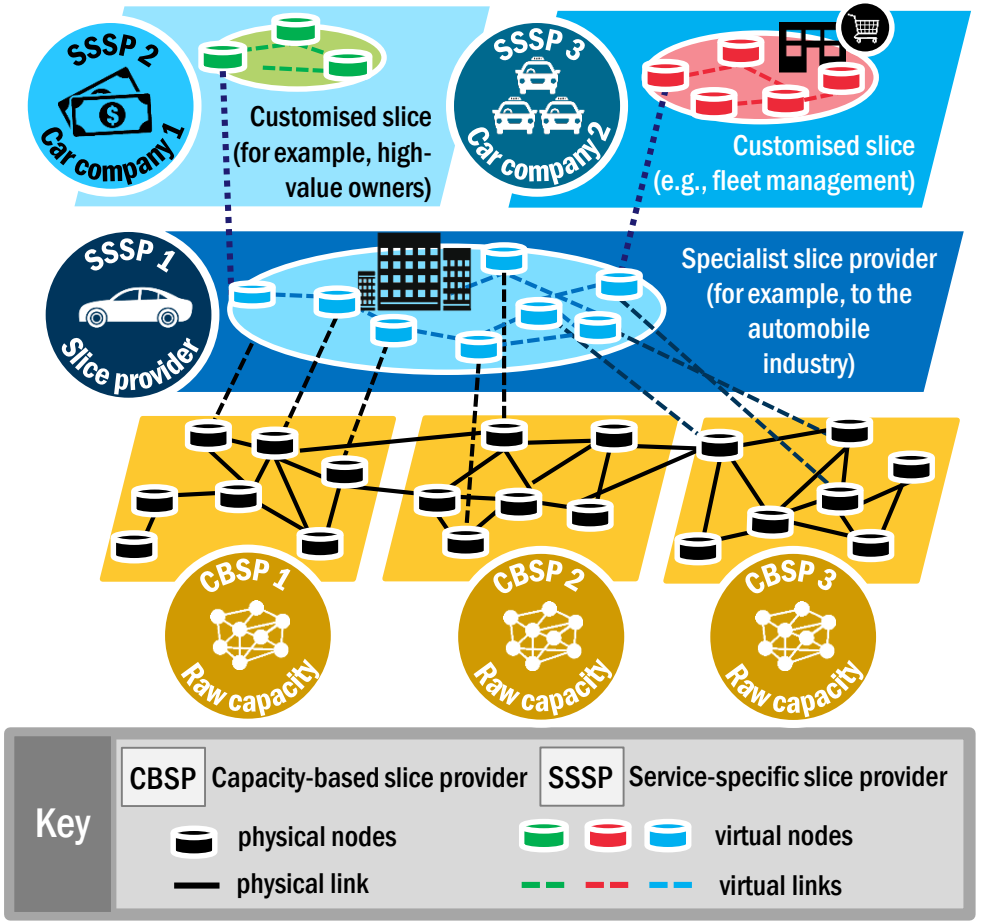
Today's networks have a uniform architecture that cannot be optimised to address the individual needs of different services now or in the future. In this report, we focus on the use of virtualisation technologies to 'slice' the physical network into multiple, separate virtual networks, which provide differentiated latency, performance, reliability, availability and other characteristics, tuned to the needs of each use case/service.

This report defines network slices as end-to-end, virtualised connectivity across multiple network domains, including fixed/mobile access, transport and data centres. It differentiates network slices from virtual private networks (VPNs) in that network slices are created on-demand and independently controlled, managed and customised, with a degree of isolation previously achievable only with dedicated physical networks.

The report distinguishes the slicing of physical infrastructure from one or more infrastructure providers into persistent, virtualised blocks of capacity, and the fully dynamic slicing of capacity-based virtual network slices into customised, service-specific slices.

Please note that this report does not consider the physical division of infrastructure through access infrastructure sharing arrangements, nor does it define network slicing solely in the context of new next-generation mobile core elements and proposed air interface mechanisms that will enable the fine-grained slicing of wireless networks.

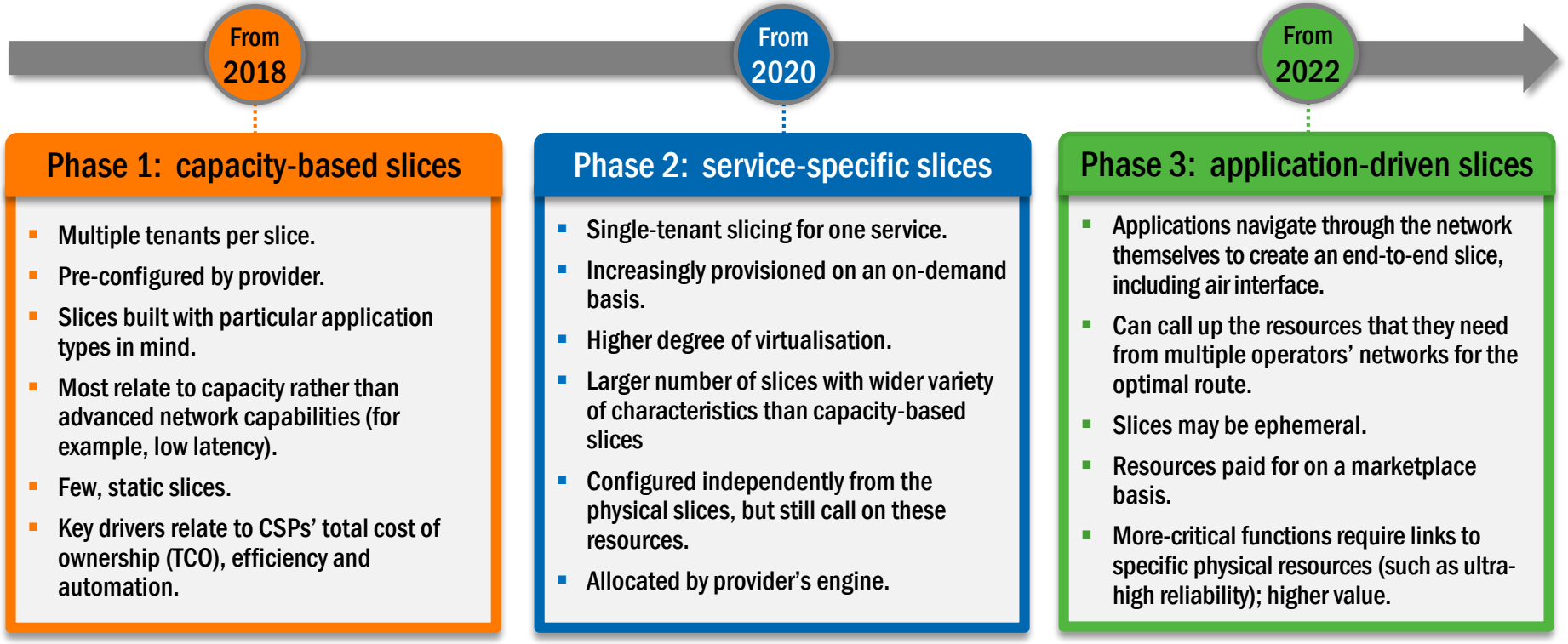
Figure 2. Hierarchy of physical/logical network slicing, shown using an example from the automobile industry



Source: Analysys Mason

Slicing can rescue the connectivity and services business case for CSPs and vendors, but only if there is a clear roadmap through the three phases

Figure 3. The three phases of network slicing



Source: Analysys Mason

Phase 1 is readily achievable, but has limitations in terms of driving new value for traditional operators. For example, until the 5G radio is implemented, fixed/mobile slicing (including the air interface) will be almost impossible. While **phases 2 and 3** have the potential to compel operators and vendors to embrace key enablers such as 5G, there is a significant risk of disruption by alternative operators (such as those providing web-scale/cloud solutions enabled by open platforms) and alternative suppliers (for example, of open-source software). If operators and vendors stay in their comfort zones, they risk delivering limited results or facing a backlash – or surrendering the initiative to disruptors.

CSPs and new service providers are laying the foundations for slicing, but different groups are at very different levels of maturity

Mainstream operators focus on network automation

- These operators are increasing the programmability of L2/3 connectivity services with SD-WAN, software-defined networking (SDN) and network function virtualisation (NFV), enabling QoS differentiation, flexible bandwidth, traffic steering and feature differentiation (vCPE).
- They are building portals that give customers increasing control over the lifecycle management of L2/L3 connectivity services.
- They are using existing control planes and network equipment with additional orchestration and management mechanisms to support these capabilities.

Advanced operators virtualise end-to-end connectivity

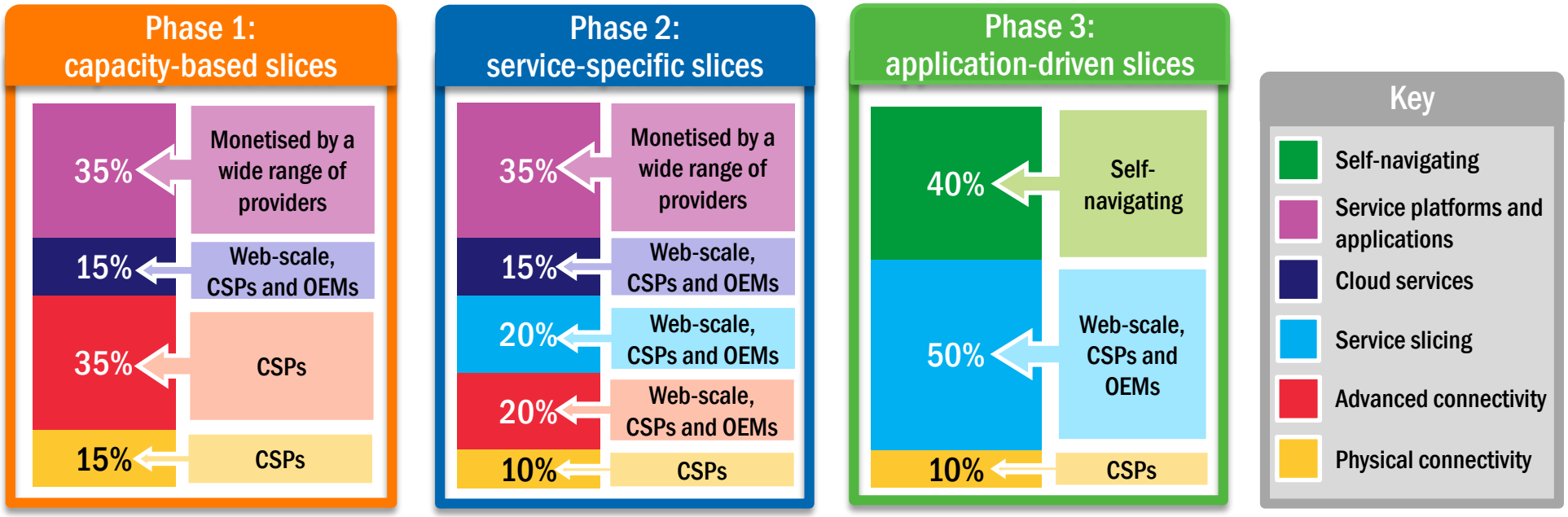
- They are transforming the network underlay.
- They provide 'all you can eat' connectivity services based on deep abilities to manage traffic seamlessly across L0-3.
- They build 'connectivity fabrics' for enterprises, with seamless integration into multiple clouds.
- They offer granular application-level QoS.
- They build new, NFV-based connectivity platforms on top of orchestrated open-source/native SDN software and hardware to support new features that can be monetised (security, extreme QoS).

Advanced third parties prepare to rule SSSP layer

- Third parties build NFV/SDN-based connectivity service platforms with application-specific features, using operator SDN-enabled underlay
- Third parties take advantage of 'all you can eat' connectivity fabrics and operator platform capabilities, underpinning their user portals/ APIs
- Examples include cloud providers, IoT platform providers, drone service providers, healthcare providers.

All players will compete for maximum penetration of the value chain as end-to-end slicing develops

Figure 4. Approximate value breakdown, showing the opportunity for different players to move along the value chain



Source: Analysys Mason

The objective for most CSPs will be to compete in as many layers of the sliced services stack as possible. They will retain control of their 'comfort zone' in best-effort connectivity and capacity slices, but these areas will have the least differentiation. Therefore, marketplace pricing will depress rates and reduce the share of the total revenue in this market. In Phase 1, physical and advanced connectivity will represent 50% of the value chain, but by Phase 3, physical slicing will account for just 10%, and advanced connectivity (optimised resources for certain services) will be part of a combined network-as-a-platform market in which CSPs will compete with web-scale players and original equipment manufacturers (OEMs). Some will also be able to move up to the services layer, which will account for 40% of total revenue in this chain by Phase 3, but this will be challenging in an environment where very diverse applications navigate their way through the virtualised networks.

Recommendations

1

Phase 1 is achievable – and justified, based on cost savings – but it must have a clear roadmap to future phases.

Vendors and CSPs can start to generate revenue now, but the real value will come from providing end-to-end slicing. They must therefore put in place the foundations for achieving this within 5 years or be squeezed into a commodity role. The operator plays a key role thanks to its expertise in connectivity – it is an obvious enabler for platforms such as GE's IIoT. However, as end-to-end and service-driven slicing emerges, further challengers will emerge across the whole chain. OEMs must decide whether to support CSPs or aim to become platforms themselves.

2

In phase 2, vendors must look for more sources of value (including services) as platforms become open source.

As technology improves there will be more flux in the value chain. CSPs will have to work harder to keep their place. Vendors must adjust to a transforming capex model, focusing on open source, the packet/optical layer, white boxes and public cloud. The number of orchestrators will decline as slicing moves from specific domains to be end-to-end. This will be offset for vendors by the chance to target non-CSPs entering the value chain. To capture that business, they need new sources of value, such as becoming platform providers themselves, to support end-to-end slicing to verticals.

3

In phase 3, CSPs may face an identity crisis as they become disintermediated by the applications; this presents new opportunities for vendors.

As slices become fully dynamic and service-driven, CSPs' direct relationship with the user will break down. The key to business value will then rest entirely in networks-as-a-platform and in the services. CSPs will have a basic value as a connectivity infrastructure provider, but could lose significant revenue to many other players. Vendors will benefit from this broader base of slice providers. Phase 3 will not start until after 2022 but its foundations need to be laid now.

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About the authors

Caroline Chappell (Principal Analyst) is the lead analyst for Analysys Mason's *Software-Controlled Networking* research programme. Her research focuses on service provider adoption of cloud and the application of cloud technologies to fixed and mobile networks. She is a leading exponent of SDN and NFV and the potential that these technologies have to enhance business agility and enable new revenue opportunities for service providers. Caroline investigates key cloud and network virtualisation challenges, and helps telecoms customers to devise strategies that mitigate the disruptive effects of cloud and support a smooth transition to the era of software-controlled networks. Caroline has over 25 years' experience as a telecoms analyst and consultant.

Caroline Gabriel is a senior contributor to Analysys Mason's *Next-Generation Wireless Networks* research programme.
Caroline contributes to Analysys Mason's published and custom research content and works directly with our research clients to advise them on wireless network trends and market developments. She has been engaged in technology analysis, research and consulting for 30 years, and has focused entirely on mobile and wireless since 2002. As co-founder and research director of Rethink Technology Research, Caroline has developed a research base and forecast methodology based around deep contacts with mobile and converged operators worldwide.

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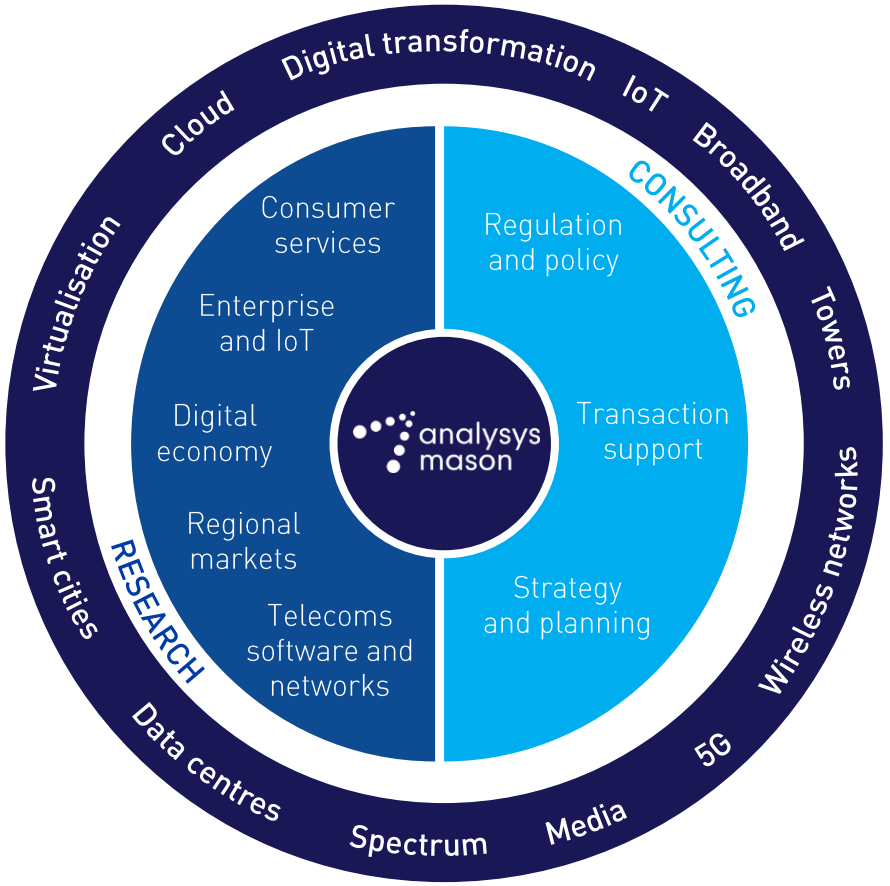

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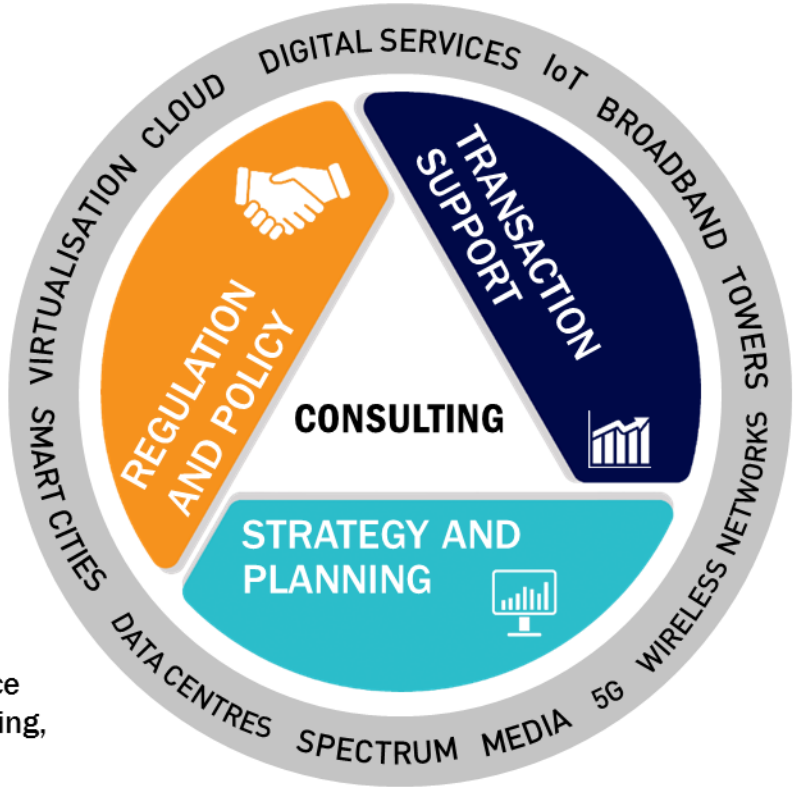

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