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Cloud-native 5G: preparing CSPs for the impact of Kubernetes (K8s)

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RESEARCH

About this report

This report describes the reasons why communications service providers (CSPs) worldwide should adopt cloud-native technologies within their systems. The report analyses the benefits that CSPs can achieve by creating and onboarding cloud-native services and products using the Kubernetes (K8s) ecosystem. It outlines the migration path from infrastructure-as-a-service (IaaS), which underpins CSPs' internal clouds (including telco cloud) to a K8s-based container-as-a-service (CaaS) platform.

Adoption of a CaaS takes CSPs a step closer to building a logical, distributed 5G digital infrastructure across multiple clouds, and it can be complemented by CSPs' further take-up of platform-as-a-service (PaaS) elements of the K8s ecosystem. This report evaluates the impact of PaaS and the implications for CSPs that deploy 5G products and services based on discrete PaaS.

Finally, the report discusses the operational obstacles that CSPs will encounter in the process of deploying a K8s-based CaaS/PaaS and the strategies that they can employ to overcome these issues.

It is based on several sources:

- desk research
- material gathered at conferences and webinars
- interviews with vendors and CSPs.

KEY QUESTIONS ANSWERED IN THIS REPORT

- What are the drivers of CSPs' adoption of K8s to support 5G?
- What approach should CSPs take to using a container-as-a-service (CaaS) alongside, or instead of, an infrastructure-as-a-service (IaaS)?
- What are the implications of K8s for application development and specifically for 5G cloud-native network function (CNF) deployment?
- What organisational and skillset changes will be required as a result of the transition to K8s?
- How does K8s affect CSPs' application delivery and support relationships between CSPs and their vendors?

WHO SHOULD READ THIS REPORT

- Senior strategy or CTO executives within CSPs, software vendors and software enablers.

Executive summary

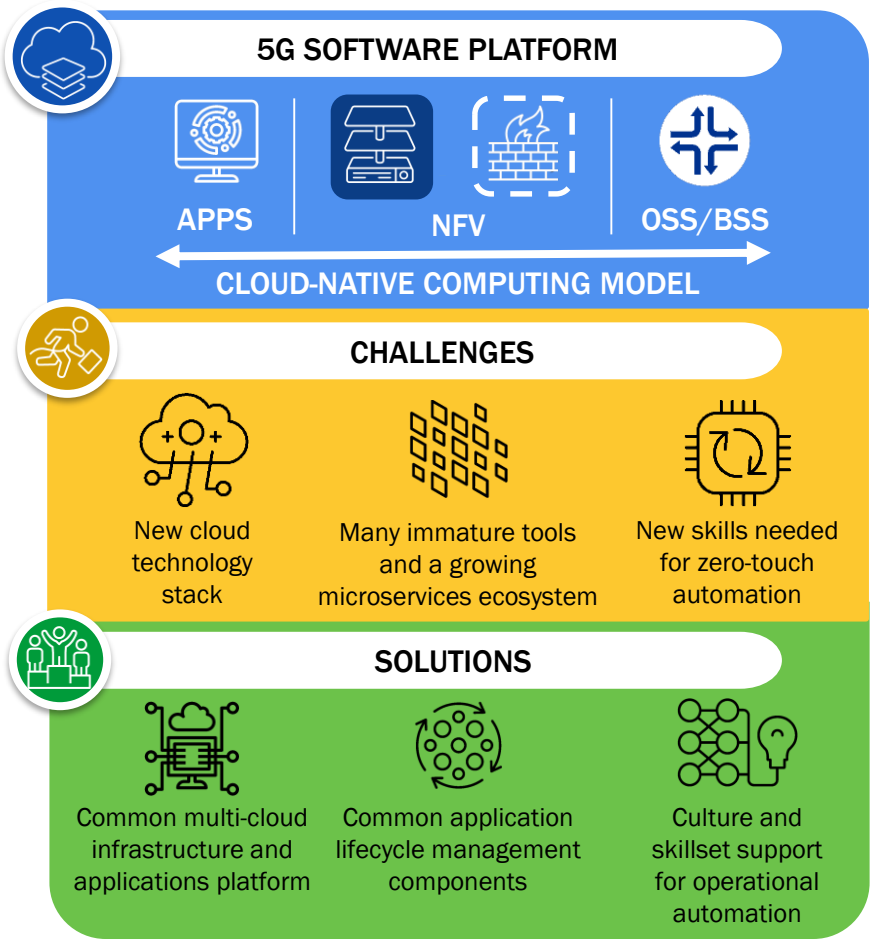
A 5G business needs low-cost, fast-to-deploy and scalable digital infrastructure to operate competitively, but the technology needed to support this infrastructure is unfamiliar and immature. Cloud-native technologies can support CSPs' 5G business goals, but implementation will require the right transition strategy from current telecoms cloud infrastructure.

CSPs are preparing to deploy 5G cloud-native network functions, including the 5G Standalone (SA) Core and edge cloud-based digital services (such as IoT and cloud gaming), which require distributed cloud-native infrastructure. A cloud-native environment built on the K8s ecosystem[1] enables CSPs to knit multiple clouds together into a logical, distributed digital infrastructure that supports multiple workloads. It gives CSPs greatest flexibility over where to run services and network functions, driving down cost at scale and speeding up delivery.

KEY RECOMMENDATIONS

1. CSPs must gain experience with K8s in preparation for the discontinuity it represents from first-generation telco cloud.
2. CSPs must create a strategy to contain K8s ecosystem complexity by establishing a common PaaS and by learning to manage vendor PaaS/CaaS deployment models.
3. CSPs should pair their cloud-native digital infrastructure with an appropriate approach to operational automation, which will require a profound change to skillsets and culture.

Figure 1: Cloud-native computing challenges and solutions



Source: Analysys Mason

[1] Kubernetes, or K8s, is the CaaS platform that is the foundation for 5G infrastructure and applications. For further details about this, see Analysys Mason's *PaaS and CaaS: tools to accelerate the development and deployment of cloud-native applications*.

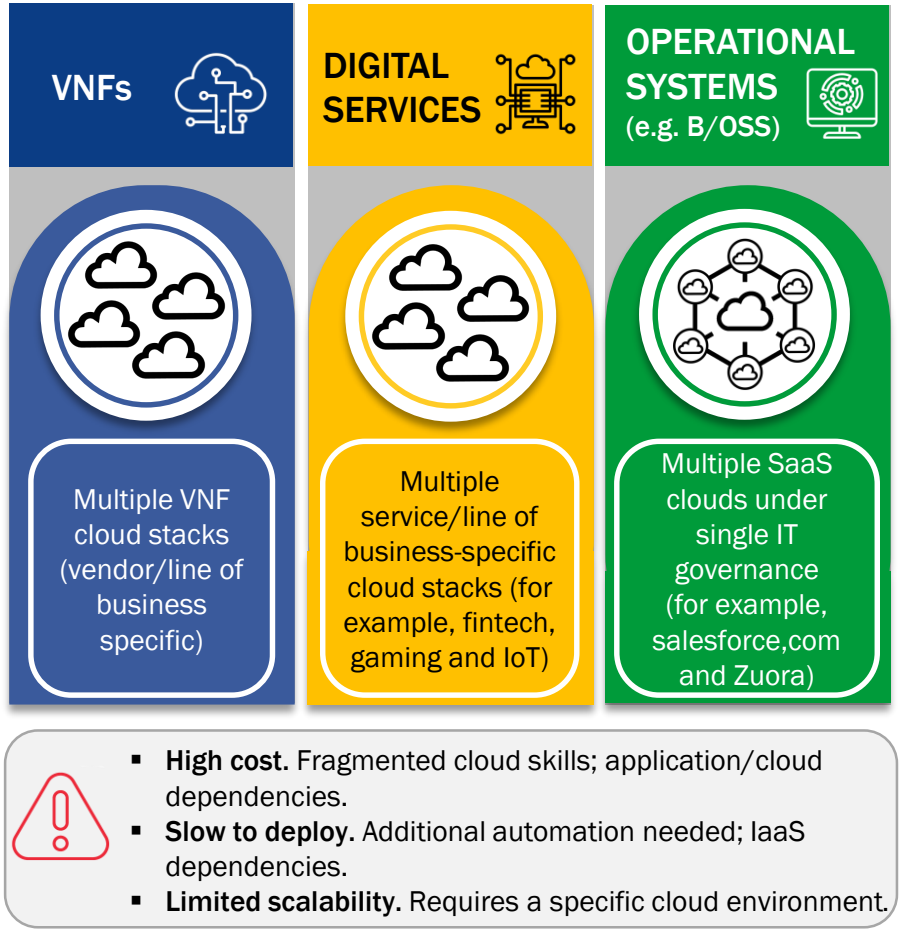
Challenge: the low cost, fast-to-deploy and scalable digital infrastructure for a 5G business and its digital workloads is based on unfamiliar and immature technology

CSPs' 5G success will depend on the ability to deliver network and related services to customers in a fast, flexible, customised and cost-efficient way but CSPs' progress towards this goal is hampered by their lack of experience with next-generation, cloud-native technologies.

The supporting fabric for 5G service delivery will be a distributed, cloud-native digital infrastructure and the cloud-native network functions, operational systems and digital services that run on it. Cloud-native software development and deployment is proven to support the creation of new services at the lowest possible cost and with fastest time to market.[1] In addition, the cloud-native stack of technologies (based on the K8s ecosystem) provides, for the first time, a common computing platform across multiple cloud infrastructures. This will give 5G players significant flexibility over where to deploy distributed applications from a cost perspective, as well as a common set of technology components from which to build and with which to manage them.

However, CSPs are unfamiliar with cloud-native technologies because their first-generation clouds – in which they are now heavily invested – are based on earlier, discrete virtualisation technologies such as OpenStack. 5G requires a single, logical digital platform: it will take cross-organisational effort to create a coherent, cloud-native strategy to replace CSPs' current, multiple cloud silos. Further, the cloud-native technology stack is evolving and CSPs' organisational culture and employee skillsets will need to adapt to take full advantage.

Figure 2: CSPs' first-generation cloud environments are based on specific virtualisation stacks, which creates silos



Source: Analysys Mason

[1] For further information, see Analysys Mason's *Cloud-native computing for telcos: definitions, challenges and opportunities*.

Solution: CSPs should phase in the K8s ecosystem in a way that addresses container immaturity, application architecture and application lifecycle automation issues

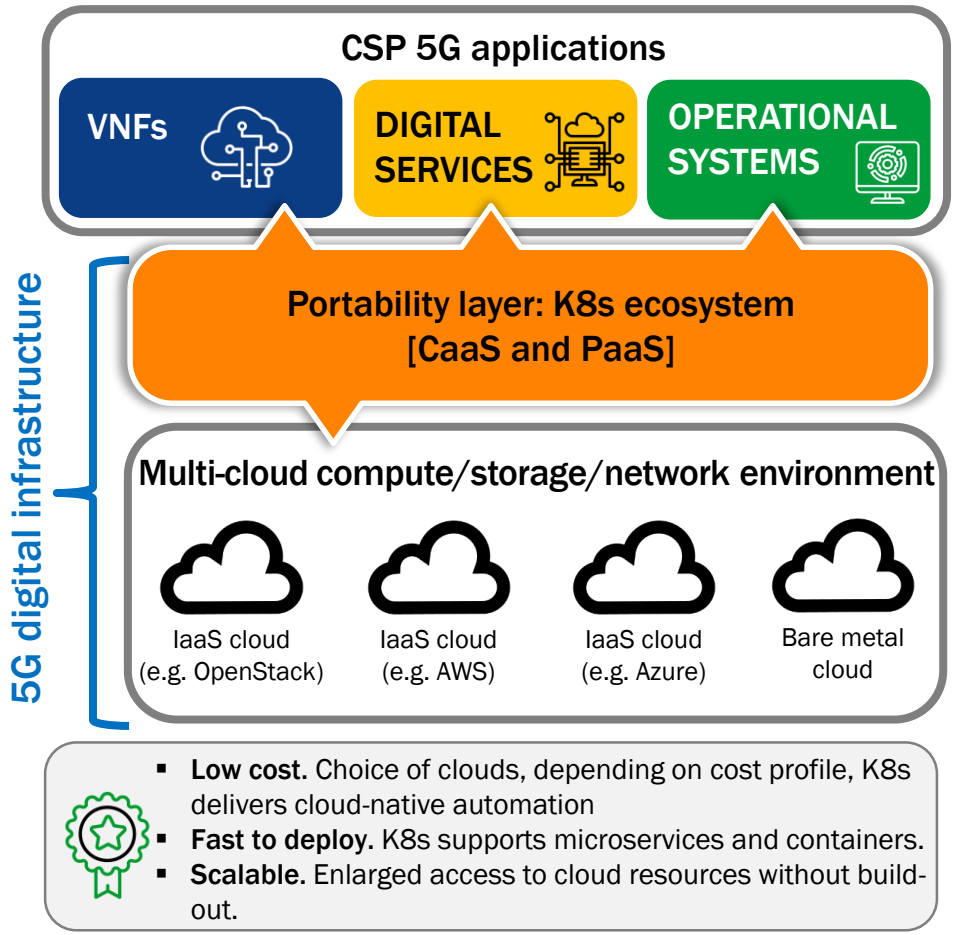
CSPs should start now to create a strategy for a cloud-native digital infrastructure that incorporates the K8s ecosystem.[1] K8s is essential for a fast, flexible and low-cost virtualised infrastructure that can run across multiple clouds.

Applications, including VNFs, digital services and business/operational systems, are increasingly being developed with – and deployed to – K8s and its pluggable components. CSPs must be able to take advantage of the multi-cloud portability and cost benefits that this development brings.

CSPs should introduce a CaaS capability to augment and potentially replace cloud-specific IaaS approaches over time. They should also work out an appropriate plan for a platform-as-a-service (PaaS) that will deal with the abundance of innovation within the K8s landscape and the uniqueness of CSPs' DevOps relationships with their vendors.

CSPs must prepare for the immaturity of the K8s ecosystem, which does not yet provide a complete or robust digital infrastructure and application platform environment (even for IT applications), nor does it adequately support the needs of VNFs/CNFs. CSPs should put in place organisational and cultural change programmes that equip them to deal with cloud-native technology shortcomings and to create required operational automation.

Figure 3: K8s must become a key 5G digital infrastructure component



Source: Analysys Mason

[1] For an introduction to Kubernetes (K8s), please see Analysys Mason's *PaaS and CaaS: tools to accelerate the development and deployment of cloud-native applications.*

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Recommendations

1

CSPs must gain experience with K8s in preparation for the discontinuity it represents from first-generation telco cloud.

CSPs need to come to terms with the transition of their cloud environment from IaaS to CaaS and the implications of this for the deployment of 5G applications. These include the ability to deploy across multiple clouds and to support multiple workload types with a single infrastructure orchestration solution. Gaining experience with K8s at the network edge is a good place to start as it needs a simpler virtualisation stack.

2

CSPs must create a strategy to contain the complexity of the vast and rapidly growing K8s ecosystem by establishing an internal common PaaS and by learning to manage disparate vendor PaaS/CaaS deployment models.

The K8s ecosystem addresses the concerns of infrastructure and application lifecycle management because the same tools can be used for both and, through its plug-in capability, K8s is infinitely extensible. CSPs must rationalise the set of K8s plug-ins that they will use internally to support automation, best practices and limit support issues, but they will also need policies to govern the third-party K8s PaaS that they acquire with vendor 5G applications.

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3

CSPs should pair their cloud-native digital infrastructure with an appropriate approach to operational automation, which will require them to make profound changes to their organisational culture and employees' skillsets.

A K8s environment is designed for automation and cannot be operated without it. K8s automation is complex and new and requires CSPs to make organisational changes to accommodate it. CSPs must prepare for both IT and network operations to change as K8s orchestration replaces IaaS and network function virtualisation (NFV) MANO orchestration with the opportunity to automate digital infrastructure and applications together in a new paradigm.

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About the authors

Caroline Chappell (Research Director) co-ordinates Analysys Mason's digital transformation research and contributes to the *Digital Infrastructure Strategies* 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.

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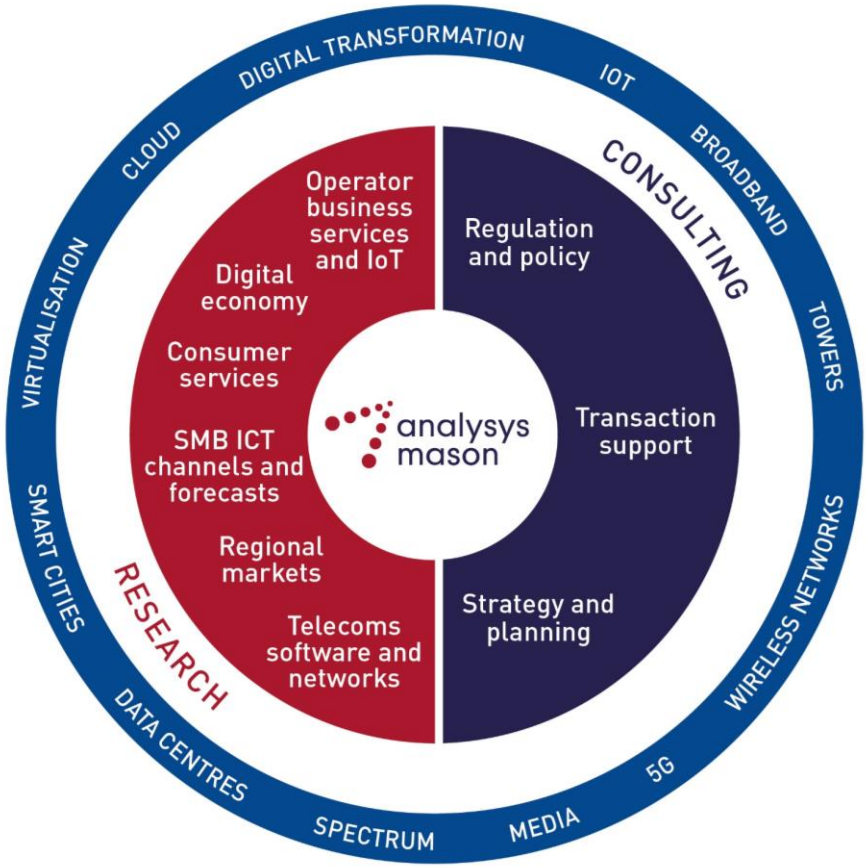

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