

The logo for stc, consisting of the lowercase letters 'stc' in a bold, blue, sans-serif font.

Perspective

stc's multi-vendor, telco cloud is the foundation for new digital services

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1. Executive summary

1.1 stc's telco cloud will power the transformation of Saudi society

stc is the leader in the provision of 5G services in Saudi Arabia, Kuwait and Bahrain, and as such, it has a deep commitment to supporting Saudi Arabia's Vision 2030. The aim of Vision 2030 is to transform Saudi Arabia into an economic and industrial powerhouse with a strong civil society. stc expects to play a key role in bringing the vision to reality as a regional digital leader that provides innovative digital services and platforms to its customers and enables the digital transformation of the Middle East and North Africa (MENA) region.

stc is undergoing an ambitious digital transformation strategy: digitize, accelerate, reinvent, expand (dare). dare is designed to turn the operator into a data-driven, agile organisation that is able to provide market-leading customer experience and new digital services for consumer and B2B markets. stc is also building an advanced telco cloud in order to deliver futureproof digital network infrastructure to the countries in which it operates. stc wants to exploit the cost-efficiency and fast time-to-innovate of the cloud in order to rapidly deploy a digital and differentiated network that supports the aims and services linked to Vision 2030.

1.2 stc is building its telco cloud in phases

stc is making good progress in its telco cloud deployment and has achieved its objective of building a telco cloud that is both compliant with the ETSI reference model and vendor-agnostic. The cloud is now in commercial operation; it runs seven virtual network functions (VNFs), involves different vendors and handles live voice and data traffic.

stc is now focusing on building closed-loop automation for the autonomous management of complex, agile telco cloud-based services, and plans to support this with a DevOps approach. stc is expanding its telco cloud roll-out to the edge of the network to support new business services, 5G network functions and services that require distributed computing capabilities, such as network slices. stc plans to evolve its telco cloud towards a cloud-native, Kubernetes-based technology stack, thereby enhancing the automation and innovation that it can support.

1.3 stc's telco cloud yields key benefits and lessons (operations efficiency)

stc has set business objectives for capex, opex and time-to-market savings that it aims to realize in 2021. stc's experience of building a successful telco cloud has led it to test a new partnership approach to vendor remuneration that rewards vendors for their support in achieving stc's specific business KPIs.

stc also points out that business processes need to be completely re-engineered in order to realize the benefits of a telco cloud environment. stc believes that this is critically important for a cloud-native environment where processes need to be very highly automated and agile. stc expects that new, automated software delivery processes and the introduction of the right DevOps skills will generate significant benefits.

2. stc has developed a new strategy for digital transformation

2.1 stc is implementing a market-leading digital transformation

stc is one of the world's top communications service providers (CSPs) in terms of market value. It was the first CSP to launch 5G services in Saudi Arabia, Kuwait and Bahrain, and it has a deep commitment to supporting Saudi Arabia's Vision 2030. The objectives of Vision 2030 are to enable Saudi Arabia to take advantage of its geographical location in order to create an economic and industrial powerhouse and to prepare Saudi society for the future. The Saudi government recognizes that sophisticated digital infrastructure is fundamental to achieving these objectives. Such digital infrastructure will enable an Industry 4.0 transformation, thereby establishing Saudi Arabia as a destination for world-leading industrial innovation. Digital infrastructure will underpin sustainable living environments within smart homes and cities and is key to the delivery of world-class education and healthcare systems, among other aspects of civil society.

stc expects to play a prominent role in providing such modern infrastructure. stc's vision is to become a global digital leader that provides innovative services and platforms to its customers and enables the digital transformation of the MENA region. As a government-owned, socially responsible company, stc is already contributing to social initiatives. For example, its infrastructure has been critical to containing and managing the COVID-19 pandemic in 2020. It supports remote learning and the monitoring and analysis of the virus, and is helping the government to enforce its guidelines to prevent the spread. stc is actively sponsoring the development of the skills that will be needed to realize Vision 2030. It funds chairs within Saudi Arabian universities to teach cloud and digitalization skills. It is an important source of internships for graduating engineers and it provides highly sought-after, market-leading training to young engineers. stc can be considered as a linchpin of Vision 2030, and it wants to ensure that its infrastructure, operations and services can support every aspect of Saudi Arabia's ambitions for the next decade and beyond.

To this end, stc is undergoing an ambitious digital transformation. stc's dare transformation strategy is designed to turn the operator into a data-driven, agile organisation that is able to provide market-leading customer experiences and new digital services for consumer and B2B markets. stc is creating operational efficiencies and laying the foundations for exceptional network quality of experience. It is also pursuing an ambitious growth strategy, and is investing in physical infrastructure and digital platform expansion. This includes the building of cloud-based infrastructure, in central data centers and network edge locations, which will support the IT and networking software that is the foundation for digital service delivery.

2.2 stc's telco cloud is a cornerstone of its dare strategy

stc understands the need to underpin its digital transformation with a modern digital network based on cloud principles and best-of-breed technologies. It was one of the first CSPs in the world to develop a horizontal telco cloud that would support all network functions, regardless of supplier, and today it has succeeded in building digital network infrastructure that was carrying traffic at the end of 2020.

stc's main motivation for building a telco cloud is to provide futureproof digital infrastructure for the countries in which it operates. As a government-owned company, stc is closely associated with Saudi Arabia's Vision 2030. For this reason, it is important that it maintains control over its set of suppliers so that it can quickly adapt to evolving market conditions. stc does not wish to be locked into a single-supplier technology stack. However, this means that it has had to focus on multi-vendor onboarding while keeping costs as low as possible.

stc wanted to realize cost-efficiencies from its cloud infrastructure, as well as reducing the time-to-innovate, by using the agile properties of the cloud to enable it to rapidly deploy new network features and services.

As well as investing in new telco cloud technology, stc has also put in place a new governance model for its telco cloud with new procurement processes, KPIs and organisational structures. It has set up a center of excellence (CoE) to carry out all integration and testing activities for the telco cloud and associated VNFs. The CoE's role is to strengthen stc's internal systems integration skills, validate new technologies such as 5G, IoT, MEC and SD-WAN and carry out RFQ and RFP processes for evaluating vendors. The CoE supports stc's Infrastructure Telco Cloud department, which is currently managed by its General Manager, Anwar Alsubhi.

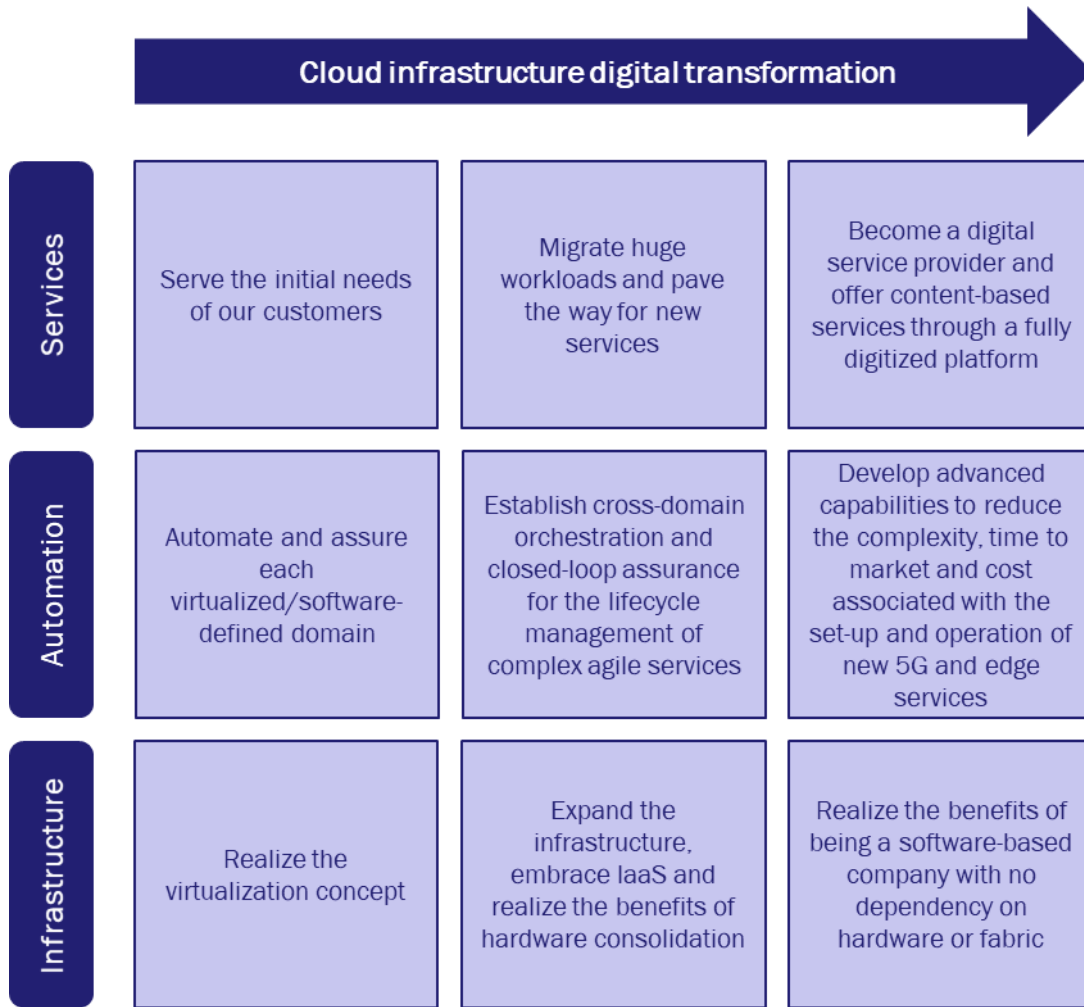
3. stc is taking a phased approach to telco cloud

3.1 There are three phases of stc's cloud infrastructure transformation

stc's telco cloud journey started in 2017 and the CSP is building its telco cloud in three phases, as shown in Figure 3.1. stc emphasizes the fact that establishing a telco cloud requires continuous development and improvement. There are no short cuts; every experience is an opportunity to learn and progress as an organization.

- **Phase one** of stc's telco cloud development has achieved its objective: to build a telco cloud that is both compliant with the ETSI reference model and vendor-agnostic. In phase one, stc established its telco cloud platform (NFV infrastructure), onboarded seven VNFs from multiple vendors, built domain-specific management and orchestration and began to support commercial network traffic.
- **Phase two** has a focus on operating the telco cloud at scale and enhancing the level of automation that it supports, including closed-loop automation for the autonomous management of complex and agile services. stc introduced DevOps approaches to the building and maintenance of automation and is re-engineering its business processes to take advantage of the speed and flexibility promised by the telco cloud. stc will also expand the telco cloud infrastructure to the network edge to support new business services and 5G network functions that require distributed computing power. stc will accompany this development with support for network slicing.
- **In phase three**, stc aims to evolve its telco cloud towards a cloud-native, Kubernetes-based technology stack. Such an environment is particularly important for supporting 5G network functions, Industry 4.0 and other advanced use cases that are at the heart of Vision 2030. stc plays an active role in the Common NFVI Telco Task Force (CNTT) and relevant open-source and standards bodies in order to support this activity. stc envisages that the cloud-native telco cloud will converge with its IT cloud infrastructure, thereby enabling new digital services that can benefit from a seamless IT/network platform and the very high levels of automation built into it. stc expects to be working in full DevOps mode in phase three, thereby enabling it to bring software-based innovation rapidly to market in support of its country's goals.

Figure 3.1: The three phases of stc's telco cloud development



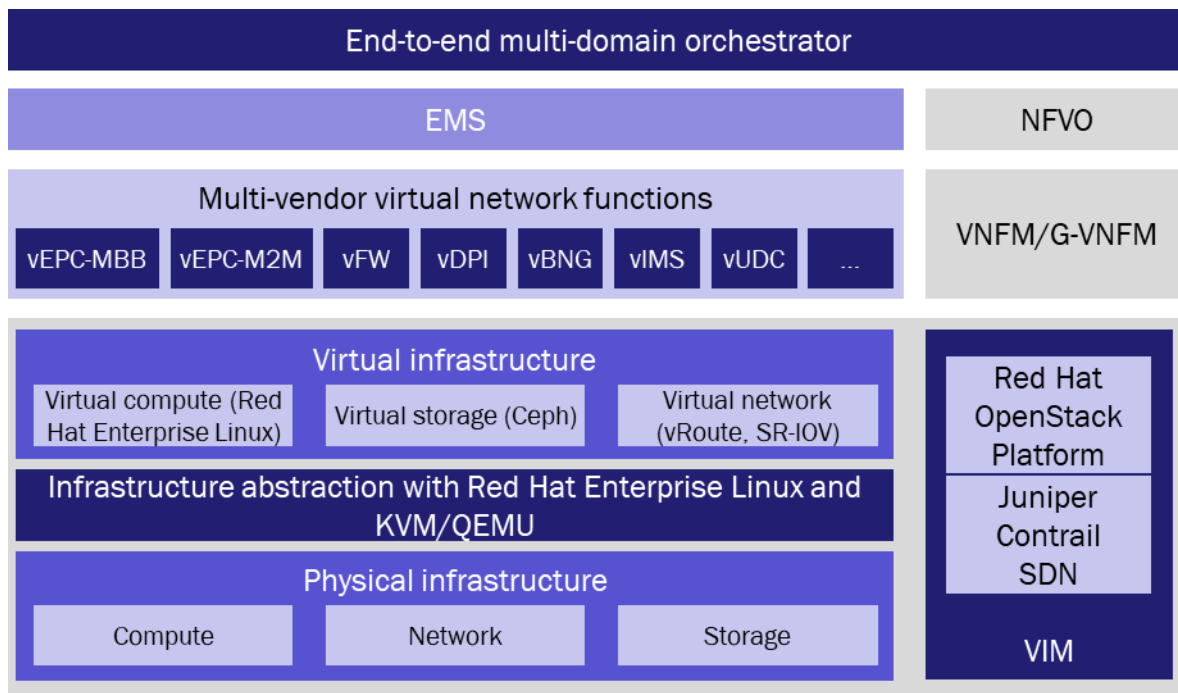
Source: stc, 2021

3.2 Phase one: building a multi-vendor telco cloud

stc's telco cloud initiative started on a small scale, led by the CSP's mobility team. stc used the packet switch for its machine-to-machine (M2M) environment to test the telco cloud concept. However, the senior management recognized the strategic significance of the technology and set up a dedicated Telco Cloud department that is responsible for building out the infrastructure and automation. It was important that the department had the right skills and could provide training and support for the telco cloud.

Figure 3.2 shows stc's telco cloud architecture. stc decided to base its telco cloud platform on the Red Hat OpenStack Platform. An open-source software strategy is aligned with stc's goal of minimizing vendor lock-in. stc follows the ETSI NFV reference architecture in its telco cloud implementation. stc's NFVI is based on an integration of Red Hat compute and storage virtualization (Red Hat Enterprise Linux, KVM and Red Hat Ceph Storage) and Juniper Contrail for network virtualization (SDN). Contrail is used to automate network provisioning, abstract and manage underlying multi-vendor switching and routing infrastructure and support service chaining. Hardware for the telco cloud is currently provided by Dell.

Figure 3.2: stc's telco cloud reference architecture



Source: stc, 2021

The virtual infrastructure manager (VIM) used in the management and orchestration (MANO) stack is Red Hat OpenStack Platform. Huawei's NFV orchestrator (NFVO) is used for network service orchestration and VNF onboarding. Each VNF vendor provides its own VNF manager (VNFM) for instantiating, monitoring, scaling and terminating the virtual machines that run their functions, although the Huawei NFVO can act as a generic VNFM (G-VNFM) if required. End-to-end orchestration will be provided by Nokia in a later stage of the telco cloud development; its service orchestration product is in the process of being integrated with the telco cloud NFVO. There has been limited integration with OSSs in phase one, but deeper integration, planned for phase two, will give the OSS full visibility of the telco cloud environment (at an equivalent level to that with the physical network environment).

stc deployed the following VNFs in its telco cloud in phase one:

- Cisco vEPC for mobile user traffic
- Huawei vEPC, primarily for M2M traffic
- Nokia vBNG
- Ericsson UDC
- Huawei DPI
- Huawei firewall
- A10 firewall.

Other functions have since been added to the telco cloud according to stc's virtualization roadmap, depending on business case and end-of-life considerations. vIMS will be deployed in phase two. Huawei was the prime integrator for the telco cloud in the first two phases, but stc's Solutions division has now taken over this role.

3.3 Phase two: automating the telco cloud

In phase two, stc has twin goals of expanding its telco cloud infrastructure and introducing the culture and process changes that are needed to operate it with a very high level of agility. stc is building automation using a DevOps approach to both achieve this aim and reduce operational costs.

stc's telco cloud currently runs across two identical data centers that host the same VNFs. The data centers handle a large volume of Wi-Fi and VoIP traffic and stc's monitoring systems confirm that these services are performing at least as well, or better, in the telco cloud as they did in the traditional, physical environment. stc added M2M and IoT applications to the telco cloud platform.

Each VNF vendor is responsible for integrating its VNF package, including VNFM, with the NFVO and NFVI. stc says that this onboarding process, including validation, takes 3–5 weeks. VNF vendors with long-standing relationships with Red Hat and experience of running on its NFVI are able to integrate their packages with minimal issues. However, stc has found that it does have to mediate between VNF and orchestration vendors when their implementations of ETSI MANO interfaces (such as SOL3) differ. stc's project management department, which manages its vendor relationships, is responsible for encouraging vendor collaboration by developing a strong spirit of partnership.

Red Hat and stc have built a staging and pre-production environment in order to accelerate cloud integration testing as part of the operator's efforts to increase automation in the telco cloud environment in phase two. stc already uses Red Hat Ansible Automation Platform for its Red Hat OpenStack Platform deployment and is now working with Red Hat to extend the use of these in a full CI/CD environment that uses infrastructure-as-code principles. Vendors will continue to manage their own functions on top of the Red Hat platform for the time being.

stc also needs to carry out horizontal integration between VNFs and other functions in its network environment, beyond the cloud. This may involve over 1000 function tests. For example, its two virtual IMS deployments need to interwork with three physical IMS functions, and only two of its nine packet switches run in the cloud. stc has implemented a high-availability environment, where any of its virtual and physical functions can take over from each other in the case of failure, so integration between these functions is key.

3.4 Phase three: stc has developed a roadmap for the future

In phase three, stc will evolve its OpenStack-based cloud to a cloud-native environment, deploy 5G network functions and eventually converge its cloud-native telco cloud with the IT cloud to complete its digital transformation. stc will eventually become an agile software company that is ready to deliver digital services in line with Vision 2030.

stc's roadmap includes the following activities.

- **Evolution of the IP/transport network** to accommodate the surge in the volume of traffic due to the growing use of 5G and M2M connectivity.
- **Building out of edge data centers** to host 5G UPF, vRAN and MEC. stc expects to test 5G standalone cores from different vendors (such as Ericsson, Huawei and Cisco) on its telco cloud.
- **Deployment of a common container management platform** to prepare stc for cloud-native network functions such as 5G network functions. stc is working with Red Hat to deploy Red Hat OpenShift as a common platform in order to avoid having multiple container management systems. stc has been testing

OpenShift since 4Q 2020. stc initially deployed OpenShift on top of Red Hat OpenStack Platform, and plans to support cloud-native network functions (CNFs) on bare metal, when ready. Eventually, stc expects to run both VNFs and CNFs on bare metal in an OpenShift container-native environment. stc expects to migrate around 10–20% of its VNFs to OpenShift on bare metal, but this is expected to take time due to lack of technology maturity and vendor readiness.

stc is participating in multiple forward-looking industry initiatives as it charts its path towards the development of cloud-native digital infrastructure.

4. stc has realized many benefits and has learned lessons from its telco cloud deployment

The promise of the telco cloud has always been to reduce capex and opex and improve time to market. Like many other operators, stc has found that all three of these metrics have increased in the initial phases of building a telco cloud due to set-up times and costs and the organizational impact involved. The virtual functions themselves may be less costly than their physical counterparts, but stc has incurred other costs, including the licensing fees for additional cloud infrastructure components and the cost of the systems integration work required.

stc attributes this situation to the immaturity of the telco cloud market and warns others that implementing a multi-vendor telco cloud may be a challenging journey because VNFs are not as ready as they need to be. However, stc expects that this situation will change significantly over the next year, and believes that it will achieve the capex, opex and time-to-market gains that it had planned for by 2021.

stc plans to realize these benefits in the following ways.

- **By introducing KPI-based pricing models.** In doing so, stc is acting on a key lesson: traditional VNF pricing models (that are still based on physical equipment) need to be replaced by pricing models that are fit for purpose in a telco cloud environment. From 2021 onwards, stc will develop a partnership-based business model with its vendors that will reward them for their achievement of stc business targets.
- **By re-engineering business processes to align them with its technology transformation.** This is also based on a key lesson: business processes need to be completely re-engineered in order to realize the benefits of a telco cloud environment. Traditionally, operators have not taken the telco cloud into account when optimizing their processes, but stc believes that its business processes and cloud are deeply intertwined. This relationship becomes even more important in a cloud-native environment where processes need to be very highly automated. stc understands that it must urgently create new, automated software delivery processes and that it must acquire the right DevOps skills to support them.

5. Conclusion

stc is providing the telecoms infrastructure that will help to accelerate Saudi Arabia's digital transformation in support of the Vision 2030 goals. World-class physical and digital infrastructure is required to meet these goals because such infrastructure is key to the delivery of the new digital services that will support every aspect of Saudi society, from its industrial and economic developments to its education, healthcare and smart city transformations. stc's telco cloud is at the heart of such digital infrastructure. The success of stc's cloud implementation is, therefore, of national strategic importance.

stc set out to build an open, resilient, flexible and scalable telco cloud, and its architectural, technical and multi-vendor product choices have been made with these objectives in mind. The operator has recognized the importance of cultural, organizational, skillset and process changes to its ability to extract the benefits of the telco cloud and create advanced digital services. stc is undergoing an internal digital transformation, guided by its dare 2.0 strategy, so that it can build telco cloud automation and future 5G and edge applications using an agile/DevOps approach, thereby enabling it to bring software-based innovation rapidly to market.

The right level of senior executive support is vital for the success of such an ambitious transformation. It is important to have both a realistic attitude about the timescale for reaping the benefits and a well-governed, phased approach to telco cloud development. stc's transformation can act as a model in this regard; it is a valuable example to the telecoms industry of the need for perseverance, innovation and transformation when implementing the telco cloud.

6. About the author



Caroline Chappell (Research Director) heads Analysys Mason's Cloud and Platform Services practice. Her research focuses on service provider adoption of cloud to deliver business services, support digital transformation and re-architect fixed and mobile networks for the 5G era. She is a leading exponent of the edge computing market and its impact on service provider network deployments and new revenue opportunities. She monitors public cloud provider strategies for the telecoms industry and investigates how key cloud platform services can enhance service provider value. Caroline is a leading authority on the application of cloud-native technologies to the network and helps telecoms customers to devise strategies that exploit the powerful capabilities of cloud while mitigating its disruptive effects.

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