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VMware Telco Cloud Automation

End to end platform for telecoms cloud automation

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Overview

VMware is a leader in multi-cloud virtualization; capable of delivering software that runs on many platforms and now managing it across those platforms. With VMware *Telco Cloud Automation,* VMware is seeking to build on its leadership in telecom multi-cloud infrastructure management, providing a complete automation capability that can deliver value added services on the Telco cloud.

VMware believes that automation and orchestration is the only way telcos can contain complexity. Cloud simplifies, but without orchestration it makes networks more complex. VMware's strategy with *Telco Cloud Automation* is to enable multi-vendor, multi cloud, multi-location networks, leveraging its familiarity as the virtualization layer in many of those clouds.

Telco Cloud Automation is deliberately termed an "automation" solution, to emphasize that the solution performs more than orchestration. VMware aim for alignment with evolving telco standards. They also provide a reference architecture that defines the network automation environment. This detail, whilst not sexy is extremely important in the success of *Telco Cloud Automation,* enabling NEPs to certify new components on a known and trusted environment. In essence VMware are implementing much of the integration and validation of network combinations that would typically have been done by the operator.

Telco Cloud Automation success is based on four foundational pillars:

1. Unifying automation across all 4 layers of cloud. (Service, xNF, CaaS, infrastructure)

2. Multi-cloud orchestration across cloud environments.

3. Product and standards-based approach – easy integration with an abstraction layer from cloud

4. Ecosystem of partners – a multi-vendor platform approach, with certification.

Telco Cloud Automation is best deployed in a solution that is using other VMware solutions. Whilst it is a good orchestration solution, it has incremental value is in combination with VMware's multi-cloud virtualization layer.

Telco Cloud Automation concentrates on VMware's core competence – VNF/CNF (virtualized workload) management. They do not, as of yet, focus on the particulars of transport service orchestration or end-to-end cross domain service orchestration. Rather, VMware is staking out a leading position in the virtualization domain.

The solution has several fundamental capabilities:

• Templates for network services, Kubernetes clusters and software configuration, defined at an abstract (neither cloud or vendor specific) level and therefore generic. They can be deployed to any telco cloud site (core, edge or RAN)

- Guidelines for onboarding VNFs / CNFs and network services to the platform

- Generic orchestration methods (logic) that act on those models

- A set of UIs to define and manage both onboarding and operation of virtualized workloads and network services

Conceptually, *Telco Cloud Automation* fulfils the functional needs of the g-VNF-M and NFV-O, but with a focus on cloudified (CNF and CaaS management) rather than simpler virtualization. To support multiple clouds, and the reality of multiple cloud locations and resource pools, *Telco Cloud Automation* operates hierarchically with both local implementations (for each cloud, or possibly a location / resource pool) and a master "*Telco Cloud Automation*" that operates across those clouds. VMware's *Telco Cloud Automation* operates across multiple locations AND flavors of cloud. The following figure shows how *Telco Cloud Automation* supports the deployment and management of a 5G cloud network.

Figure 1: Deploying Telco Cloud in a 5G Network
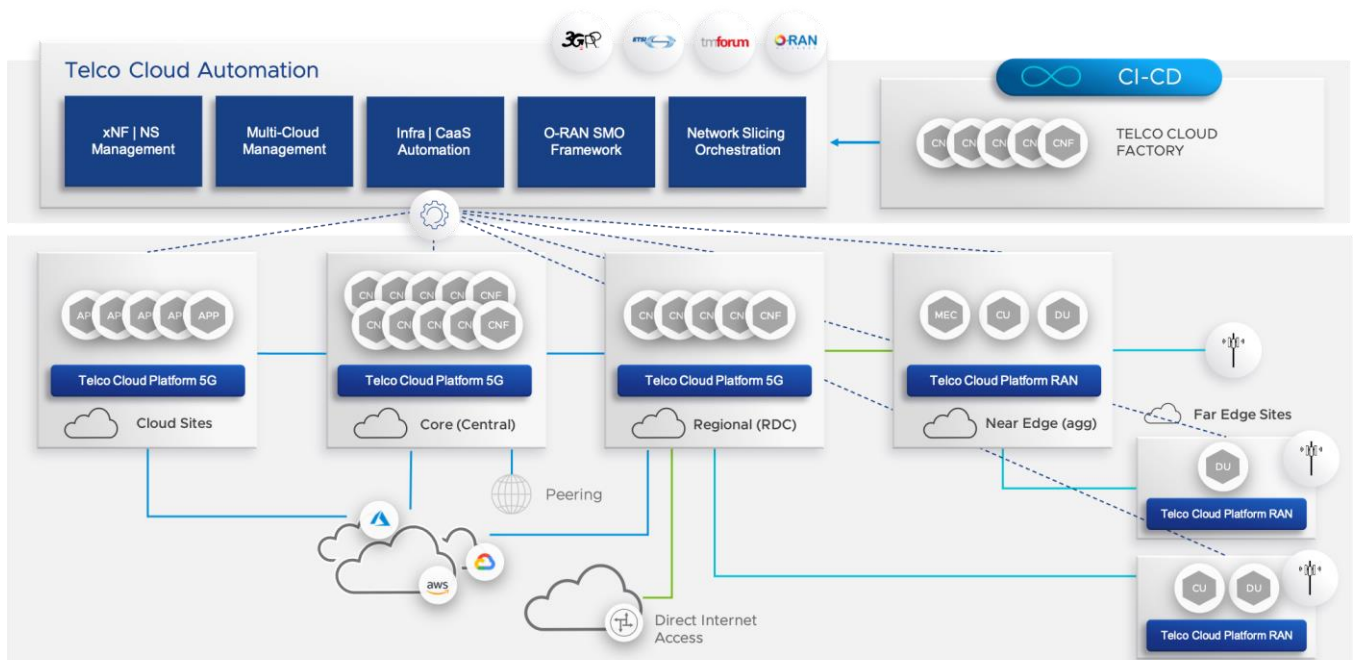
Source: VMware

Customers

The following table shows selected *Telco Cloud Automation* customers, showing the problem being solved.

Customer	Problem	Approach to Problem	Implementation	Business Outcome
Dish	Refactoring on AWS would cost too much and take too long	VMC provides cloud independent solution with *Telco Cloud Automation* providing integrated automation	Deploy *Telco Cloud Automation* and VMC	Automated solution to meet Dish's network launch
Dish	Multi-domain service orchestration	Build on top of existing VMware management of infrastructure workloads in control and management plane	Future work	Enabling Dish to proceed with as much automation as possible.
Vodafone	Improved bandwidth in RAN	Open RAN RIC implantation with Cohere xApp	*Telco Cloud Automation* used to orchestrate test RAN using VMware RIC, Cohere xApp and CapGemini vRAN.	Test validation of possible RAN capacity increase solution.
Vodafone	Wish to be leading digital telco	Introduce modern cloud-based technology and automation	*Telco Cloud Automation* enables Vodafone to improve speed and efficiency of managing customers.	Cost of core network reduced by 50 percent

Telco Cloud Automation key capabilities

User Interface

Telco Cloud Automation provides a fully functional user interface to support the management and onboarding of new network functions and services. In this UI a user can (among other capabilities) create a new function or network service, apply a template, activate, terminate, view and configure. All aspects of the UI are also available directly through an API. The UI is designed to support CI/CD working practices with cloud native functions.

Figure 2: Infrastructure Automation visualization in *Telco Cloud Automation*
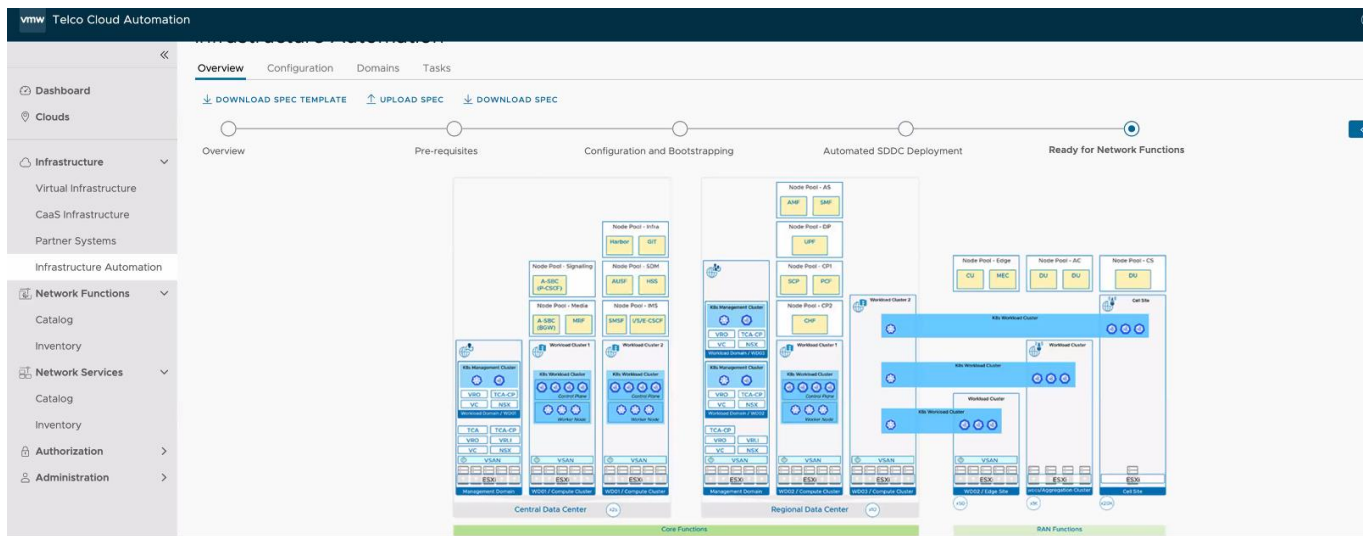
Source: VMware

Lightweight edge deployment

Telco Cloud Automation has been designed with the needs of the edge, and particularly the far edge at cell site, in mind. *Telco Cloud Automation* enables clusters that can be spread across multiple locations. It also enables the lightweight deployment at a cell site, with centralized cluster management, and only worker nodes at cell site. This is different to a typical core network approach. It is worth emphasizing how different the edge network operational challenges are:

- At the edge resources are limited and expensive

- A system must make choices on what to put at the edge vs. core

- A system must choose which edge site to select, and even if placement within requirements is possible.

By contrast. in the core the assumption is often "infinite capacity".

Onboarding

Telco Cloud Automation recognizes that whilst the underpinning of VNF and CNF is different, network services need to behave the same way and be capable of combining both. *Telco Cloud Automation* treats VNF and CNF the same in terms of onboarding and lifecycle management. *Telco Cloud Automation* provides a DevOps environment in which VNFs and CNFs into a service (topology and lifecycle). This is important during the (long) transition period in which older-style virtualization coexists with full cloudification.

Figure 3: Onboard network function interface
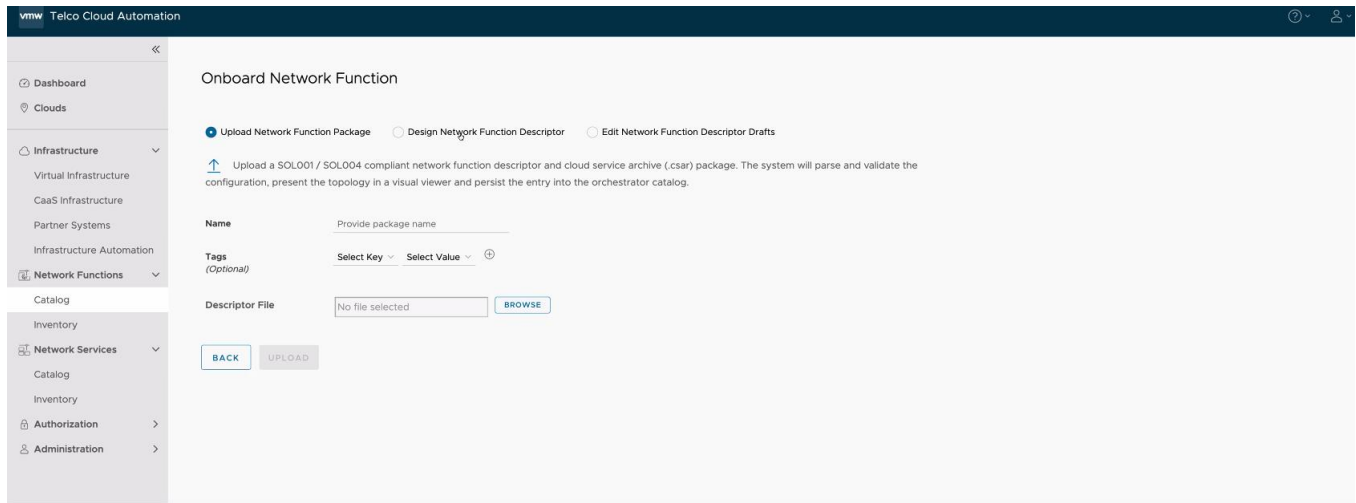
Source: VMware

Built for the practicalities of the distributed telco cloud

Unlike a public cloud operator or large enterprise, where 5-10 datacenter facilities in a large nation would be a large number, telecom firm may have 100s or 1000s of edge locations, and the workloads placed on them have very tight performance and latency tolerances. *Telco Cloud Automation* has been built with these network operator needs in mind. This is particularly where cloud hardware is distributed and where cloud hardware at a location cannot be assumed to have infinite capacity and rollback is a significant issue. *Telco Cloud Automation* always does a capability analysis first to determine whether infrastructure can support CNF. *Telco Cloud Automation* can initiate many actions, such as reboot, to make sure that CNF can work. Spinning up of a network functions does not proceed until infrastructure is ready for CNF or VNF.

In addition, the high variability of infrastructure need from telco CNFs is catered for with "late binding". Generic Kubernetes clusters are created but with late binding of the exact infrastructure requirement for each specific CNF. "Late binding" allows detailed network function container requirements to be hidden from higher network layers, allowing repeatable/consistent operations. Cloud resources are abstracted to the higher layers, with the exact configuration achieved on-demand, based on the exact network function requirements.

Figure 4: CaaS infrastructure cluster configuration
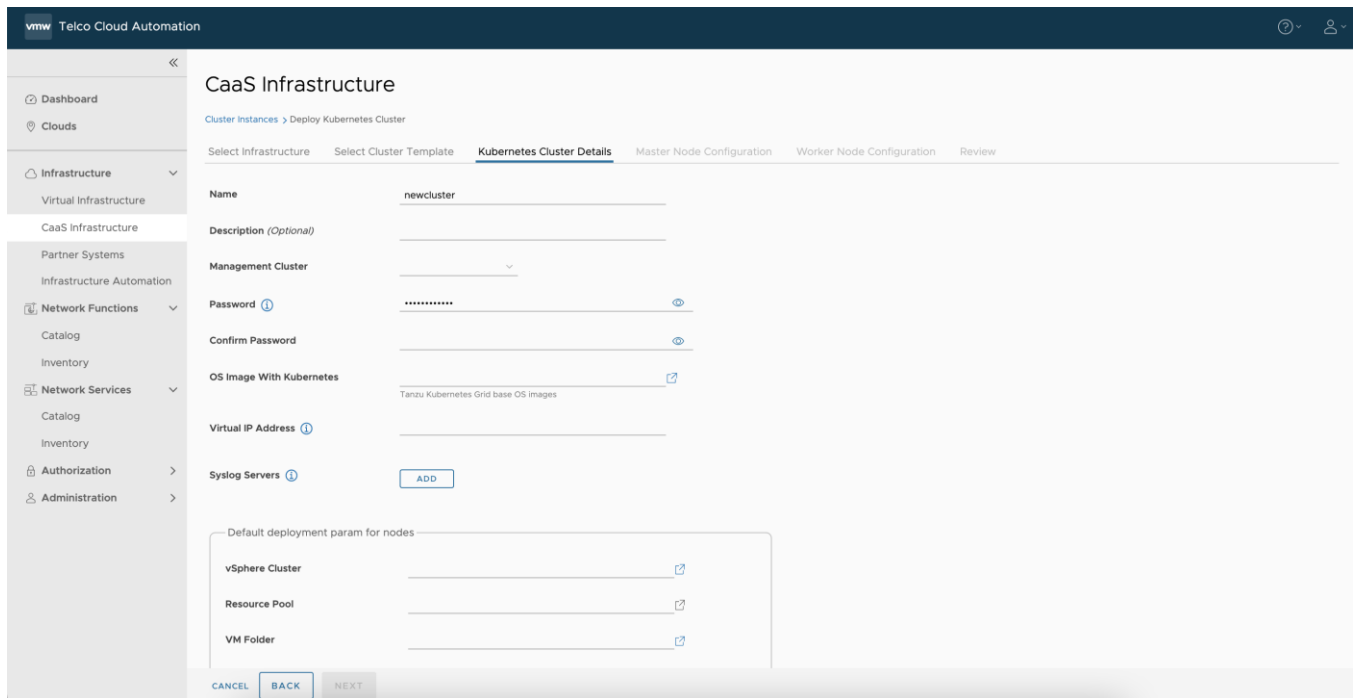
Source: VMware

Certification framework

Telco Cloud Automation provides a reference architecture that defines the environment in which network functions will operate, and templates for each within the system. NEPs are able to certify on this environment, giving operators the foundation on which to more easily accept these functions into their networks. VMware publish a reference architecture per component and network service. This is not a glamourous technical capability, but it's extremely important for the adoption and use of software networks by operators.

The *Telco Cloud Automation* UI is used by the certification tool and generates TOSCA templates for the lifecycle of each component in the certification framework.

Competitive Position

Telco Cloud Automation competes with traditional NEPs providing their own vertical solutions of orchestration bundled with VNFs and CNFs. NEPs leverage their reputation for reliability and provide a single point of responsibility for the stack from hardware up through management middleware, to the network loads themselves. Proprietary stacks reduce risk but also *potentially* reduce support for multi-cloud and multi-vendor environments. VMware have a strong competitive advantage with NEPs in multi-vendor networks, where the need to deploy complex use cases across vendors becomes difficult because of vendor neutrality issues and cooperation. VMware are able to provide a neutral orchestration and automation. For example, an operator using *Telco Cloud Automation* for core is having to integrate domain managers from Nokia, Ericsson and Oracle.

Telco Cloud Automation also competes with VNF management solutions from OSS/BSS providers and NEPs. VMware have an advantage in being multi-vendor and supporting multi-underlay clouds. VMware aims has a strong product first position, a standards alignment and a certification and validation program

SWOT analysis

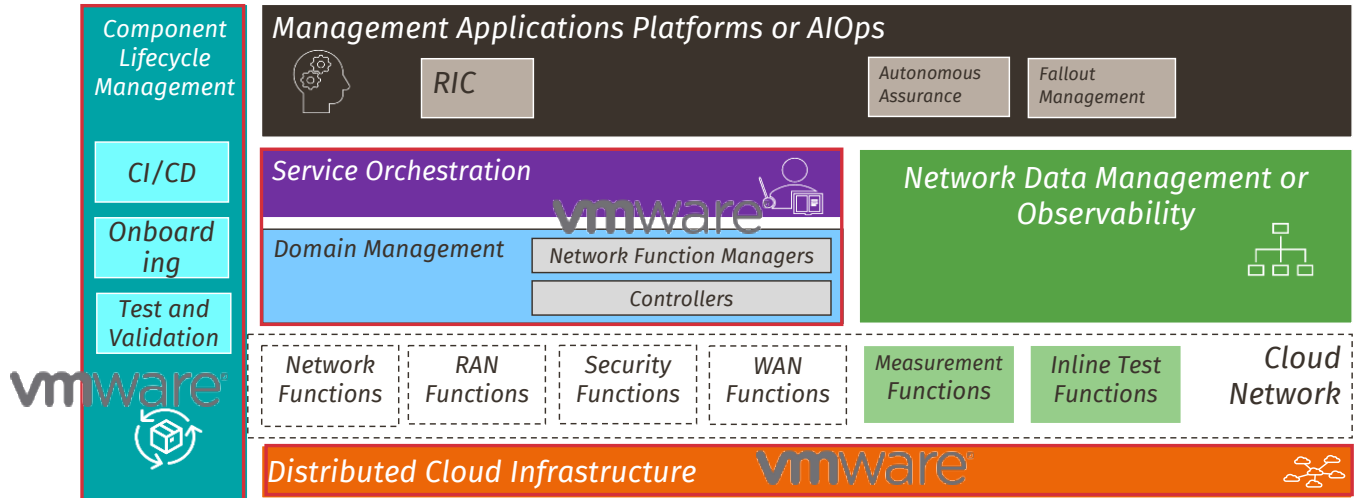| Strengths	Opportunities
• Network vendor neutral • Reference architecture and certification • VNF/CNF neutral • Telco edge specific cloud solution which supports a distributed and resource constrained environment • Strong multi-cloud foundation with proven experience across cloud vendors	• Opportunity for VMware to take wider role in priming telco automation solutions. • As virtualization and cloud native networking extends so does the opportunity for a strong non-NEP siloed automation solution. • Increased service management and orchestration need with virtualization in Open RAN and 5G network slicing
Weaknesses	**Threats**
• Solution still requires operator to manage system integration. Integrated NEP solution may be preferred in many operators where in house development not present • *Telco Cloud Automation* benefits are less differentiated in a non-VMware cloud environment.	• Direct implementation on hyperscale providers bypassing VMware multi-cloud position. • Ongoing lock in to hyperscale provider and/or NEP vertically integrated solution. • Most players, including NEPs, are slowly moving to support the same capabilities; but in practice are typically not there yet.

Appledore assessment

Telco Cloud Automation focuses on a distributed, multi-vendor and multi-cloud environment. It provides CNF/VNF orchestration, Network Service Orchestration, cloud abstraction and cross domain placement capabilities – all capabilities that are too often overlooked in solutions of the recent past and present. Functionally, *Telco Cloud Automation* provides a domain management framework capability, component lifecycle management in the form of onboarding and test validation, as well as being tightly integrated with their underlying distributed cloud infrastructure management capability.

Telco Cloud Automation aligns well with Appledore's view of the future nature of cloud native network applications.

Appledore has advocated these capabilities since 2015, and is pleased to see leading suppliers stepping up to handle this complexity. Without them the benefits of cloud are not fully realized.

Figure 5: *Telco Cloud Automation* **mapped to Appledore's Network Automation Taxonomy**

Source: Appledore Research

Taxonomy Category	Evaluation	Business Impact
Component Lifecycle Management	• Strong framework for onboarding and lifecycle management • Reference framework for the test and validation of network functions. • Reference framework pre-defines fundamental automation activities, driven by onboarded models.	High
Service Orchestration	• Orchestration of end-to-end services across domains • Create Network Services both topology and configuration.	Medium/Low

Taxonomy Category	Evaluation	Business Impact
Domain Management	• Orchestration across multi-vendor multi cloud infrastructure • Focus on domain orchestration, multi-vendor, VNF/CNF • Focus on g-VNF-M and NFV-O • No transport orchestration • Heavily linked to existing VMware distributed cloud infrastructure. • "Late binding" capability allows diverse, network functions to be managed consistently, whatever the requirements of the network function. Enables abstraction of cloud resources to higher layers (a key Appledore requirement) and allowing configuration on-demand, based on the exact network function requirements.	High
Distributed Cloud Infrastructure	• CaaS management • Leading provider of multi-cloud infrastructure • Pre-integration with *Telco Cloud Automation* for VMware own automation.	High
Overall solution	• With strong integration of VMware cloud and Telco Cloud Automation the overall solution provides a strong solution for the overall automation of new software driven networks for those using a VMware underlying infrastructure. • Telco Cloud Automation does not do everything, but in the VNF/CNF and virtualized NFS space, they do things very well and are one of the very few solutions with demonstrated capabilities across vendors, clouds, and locations.	High

About the Authors

Francis has 25 years of experience in telecoms BSS and OSS software. Previously he was responsible for innovation and strategy in Ericsson's software solutions business and in Telcordia. Within this role he set and reviewed the strategic direction of both product and customer program delivery.

Before Telcordia he was VP - OSS Architecture at Cramer Systems. He was one of the original employees of Cramer and was responsible for the development of its professional services organization and its strategic deployment architecture. He has also led BSS development teams at BT and Convergys.

Dr. Haysom received his PhD from the University of Bath and a BSc in Engineering Science from the University of Exeter.

Grant provides a unique combination of management and technical acumen, combined with 30 years of successful innovation in both technology and business models. He most recently served in the office of CTO for Ericsson. Through his career, Grant has specialized in transforming telecom software and service businesses in the face of dramatic market and technology shifts, positioning the businesses for survival and growth in new environments.

Grant has deep experience in understanding market and technology shifts, and the consequent opportunities and threats that these shifts create. He has consistently guided the Telcordia and Ericsson software product portfolios to thrive on these changes. Grant holds a Bachelor of sciences from Drew University and an MBA (SM-Management, SM-Engineering) from Massachusetts Institute of Technology.

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